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THE DIAGNOSIS OF ENLARGED BRONCHIAL GLANDS*

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The term bronchial glands, as usually applied, includes not only the lymph-nodes about the bronchi, but also the peritracheal, infratracheal and hilus groups. The tracheal group consists of from seven to ten nodes situated along either side of the lower part of the trachea, more numerous on the right and varying in size from a pea to the size of a bean. The bronchial glands proper include the infratracheal group and the glands about the stem bronchi. They attain their greatest size and are most numerous beneath the right bronchus. The tracheal glands are in relation to the superior vena cava and with the vagus and recurrent laryngeal nerves. The left recurrent nerve, because of its lower origin, is in contact with the trachea for a much longer distance and is more liable to compression than the right one. When these glands are swollen, they may be in contact with both common carotid arteries, innominate veins, arch of the aorta and the phrenic nerves. The group at the bifurcation of the trachea is posterior to the pericardium and anterior and slightly to the right of the esophagus. The vagus nerve is also in relation to this group. When enlarged, they may press on the spine to the right of the esophagus. The hilus glands are in contact with the bronchial and pulmonary vessels and with the lung. As the trachea extends downward it inclines to the right so that at its lower end it is in the right sternal line arteriorly, and to the right of the center of the vertebral column posteriorly. The point of bifurcation in children is about the fourth thoracic vertebra and in adults at about the intervertebral cartilage between the fourth and fifth thoracic. From the arrangement of the lymph-nodes in Figures 1 and 2 it is seen that they are considerably more numerous on the right than on the left. Enlargement of the bronchial nodes may be present in any disease affecting the lymphatic nodes throughout the body, as, for instance, Hodgkins' disease or lymphatic leukemia, with malignant dis-

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eases of the lung and with various pulmonary infections. In a patient convalescent from scarlet fever who developed enlarged cervical glands, I was able to detect a synchronous enlargement of the bronchial nodes. A very large percentage of these enlargements, however, are of a tuberculous nature. It has long been known that a tuberculous infection of the nodes may antedate the involvement of the lung by months or even years, yet until comparatively recently but little attempt has been made to diagnose the condition while it is still limited to the bronchial nodes. According to Harbitz,[1] the bronchial nodes, using the term in its strict sense, are not as often the source of the primary infection as those of the hilus,

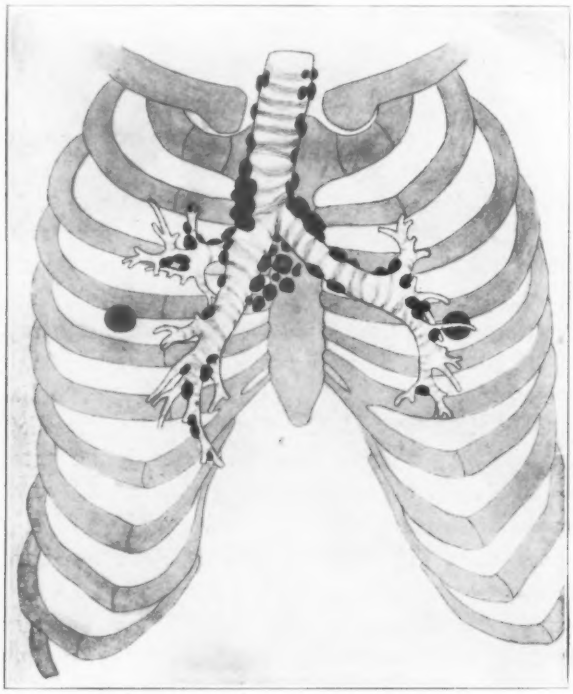

Fig. 1.—The relationship of the bronchial glands to the anterior thoracic walls of the adult. In the child the bifurcation of the trachea is behind the right of the sternum at the level of the third costal cartilage. The glands are according to Sukiennikow (Berl. klin. Wchnschr., 1903, xl, 316, 347, 369), and the trachea and bronchi are after Blake (Am. Jour. Med. Sc., 1899, cxvii, 320).

tracheal or infratracheal groups. Wollstein[2] found the largest nodes on the right side in 74 per cent. of her cases. Infection of the lung takes place either as the result of rupture of a caseous node into a bronchus or

1. Harbitz: Jour. Infect. Dis., 1905, ii, 143.
2. Wollstein: Arch. Int. Med., 1909, iii, 221.

by way of the lymphatics. In children under 1 year, Sluka[3] always found, by means of the *x*-ray, that the disease had extended beyond the nodes unto the lung.

SYMPTOMS

In a great many instances slight involvement of the bronchial lymph-nodes causes no symptoms. While the children with tuberculosis of these nodes are usually delicate in appearance, such is not always the case. Both adults and children may look the picture of health, even when the symptoms and signs are definite. The realization of this is of the utmost importance. When tuberculous, the symptoms are in part caused by the toxin of that disease and in part are the result of pressure. We find that

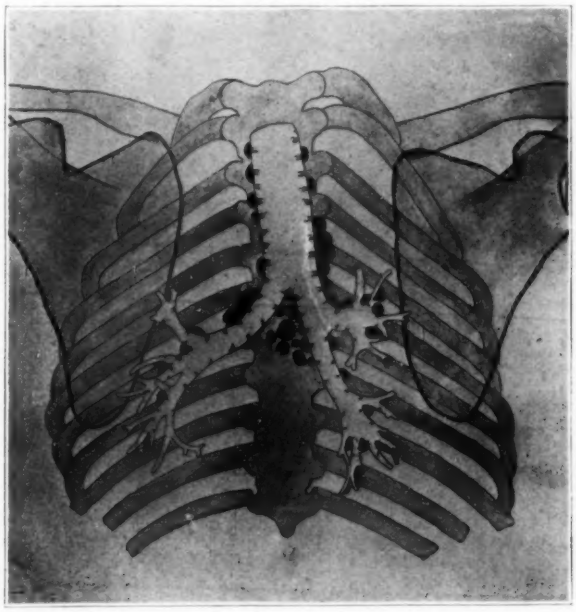

Fig. 2.—The bronchial glands as seen from behind. In the child the trachea bifurcates at about the level of the intervertebral disk between the fourth and fifth thoracic vertebræ which corresponds nearly to the tip of the fourth thoracic spine (Blake). It is slightly lower in the adult. This drawing and the preceding one are from radiographs of an adult cadaver into whose trachea a metallic alloy had been injected.

these patients are easily fatigued, capricious in appetite and often irritable in disposition. The insidiousness of onset and the lack of definiteness of the symptoms is quite characteristic. An interscapular backache is sometimes complained of and, when present, it will usually be found that pressure over the upper thoracic spines will elicit tenderness. Sometimes

3. Sluka: Wien. klin. Wchnschr., 1910, xxiii, 156.

a more or less constant pain is complained of within the thorax. It rarely can be definitely located, but is usually between the mammary lines. Sometimes it is sharp and darting in character and it may be brought on by deep breathing or extra exertion. Vasomotor instability is shown by the flushing of one or both cheeks; this is sometimes a very annoying symptom. Puffiness of the face and especially under the eyes from pressure on the venous trunks may give the facies of nephritis. The superficial thoracic veins are often dilated. Increased frequency of the pulse is often present and the temperature is apt to be low in the morning and may reach 99 F. or higher in the afternoon, though it may be sub-

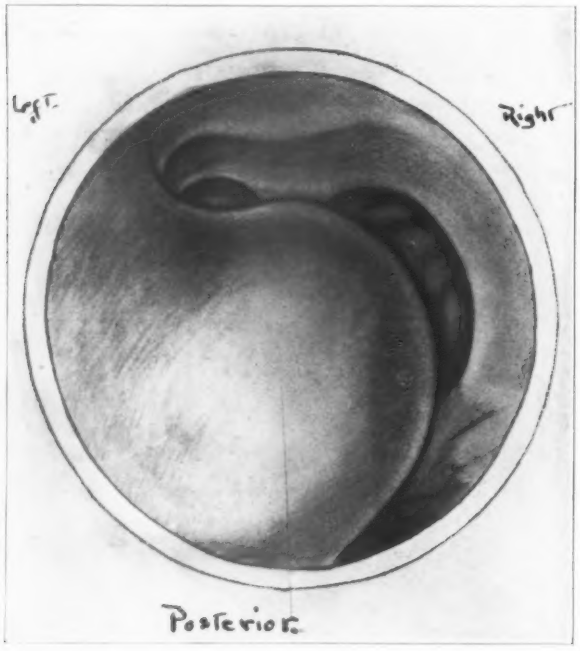

Fig. 3.—Bronchoscopic appearance in a case of tracheal compression from enlarged bronchial glands (Guisez). The extreme dyspnea was at once relieved by the bronchoscope, which was introduced very easily.

normal continuously. Krämer[4] has observed an increased sensitiveness to cold, especially in the region of the shoulders. There may be more or less indigestion, hydrochlorhydria, according to Philippi,[5] being most frequently present. In women all of these symptoms are apt to be more marked at the menstrual period. A brassy cough is usually the first thing to excite concern, although the glands may reach a large size with

4. Krämer: Beitr. z. klin. d. Tuberk., 1909, xiv, 335.
5. Philippi: Beitr. z. klin. d. Tuberk., 1911, xxi, 67.

practically no cough, as they did in the case from which Photographs 10 and 11 were taken. The paroxysms of coughing may be so severe as to resemble whooping-cough, frequently gagging results and sometimes even vomiting. In some instances patients have to support themselves by holding on to something during these coughing spells. The caseous node may be expectorated after rupture into a bronchus, as occurred in Hall's[6] case.

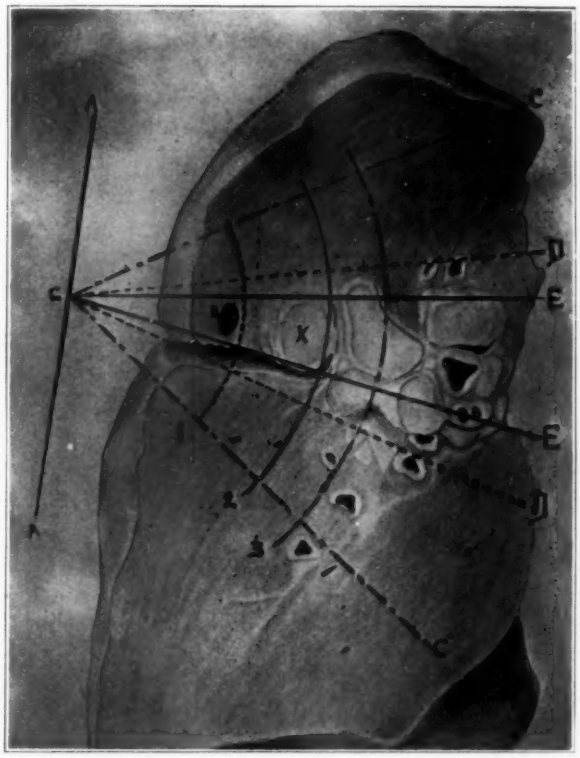

Fig. 4.—Antero-posterior section of a lung showing bronchial glands (Northrup). The line A represents the skin surface in the interscapular space; B, area of consolidation. The triangle C-C-C shows the vibrating area with heavy percussion; D-C-D, light percussion; E-C-E, very light or tapping percussion. Arc of circle No. 1 shows sufficient penetration for a superficial lesion B, but insufficient to reach gland X; Arc 2 represents the essential depth, attained with both light and very light percussion; Arc 3 shows that the slightly increased depth obtained with heavy percussion is not in proportion to the increased width of the vibrating area.

In infants dyspnea may be the most marked symptom. As a rule, it is chiefly or wholly expiratory in character and due seemingly to a vagus

6. Hall: Am. Jour. Med. Sc., 1899, cxviii, 185.

neuritis from the pressure of the swollen nodes. This was so in Hoover's[7] case, and Virot and Guinon[8] also found that the stridor was caused by nerve irritation rather than direct compression of either trachea or bronchus. Einthoven,[9] moreover, was able to throw the bronchial muscles into spasm by vagus stimulation.

Schick,[10] however, thinks compression of the trachea and bronchi occurs more often than is usually stated, and Guisez[11] reports a case

Fig. 5.—A A, line of vertebral spines. Continuous line includes area of bronchial gland dulness. Dotted line shows area over which whispered bronchophony was heard. For *x*-ray picture, see Figure 16.

7. Hoover: Jour. Am. Med. Assn., 1911, lvii, 1734.
8. Virot and Guinon: Quoted by Aviragnet, Bull. Soc. de pédiat. de Paris, 1911, No. 3, 126.
9. Einthoven: Quoted by Hoover (see note 7).
10. Schick: Wien. klin. Wchnschr., 1910, xxiii, 153.
11. Guisez: Bull. Soc. de pédiat. de Paris, 1911, No. 3, 144.

from which Figure 3 is taken, and in which there was marked tracheal compression. It would seem that compression might easily occur when the pressure was exerted from behind, owing to the absence of cartilage posteriorly.

The dyspnea of infants is divided into three classes by Marfan,[12] first, wholly inspiratory, due either to congenital vestibulo-laryngeal stenosis or paralysis of the dilators of the glottis; second, expiratory and inspiratory, but chiefly the latter, usually caused by the pressure of an enlarged

Fig. 6.—The outward dislocation of the upper inner line of pulmonary resonance is here shown, more marked on the right than on the left. The dotted lines show wide area of transmission of the whispered voice. For *x*-ray picture, see Figure 17.

thymus; third, chiefly or exclusively expiratory, the result of stenosis from either tracheal or bronchial nodes.

Aviragnet[13] has reported a case in which the stridor was wholly inspiratory and for this reason an enlarged thymus was diagnosed. At

12. Marfan: Bull. Soc. de pédiat. de Paris, 1911, No. 3, 131.
13. Aviragnet: Bull. de la Soc. de pédiat. de Paris, 1911, No. 3, 126.

the autopsy a large number of tuberculous lymph-nodes were found, in which were imbedded the recurrent laryngeal nerves. The dyspnea in this case was presumably due to paralysis of the dilators of the glottis. Dyspnea developing after an acute pulmonary infection is usually due to swollen lymph-nodes rather than to an enlarged thymus. Schick[10] observed that the expiratory stridor was more apt to be present when the child was resting quietly and that a hard attack of coughing or the disturbing of the infant would cause the dyspnea temporarily to disappear.

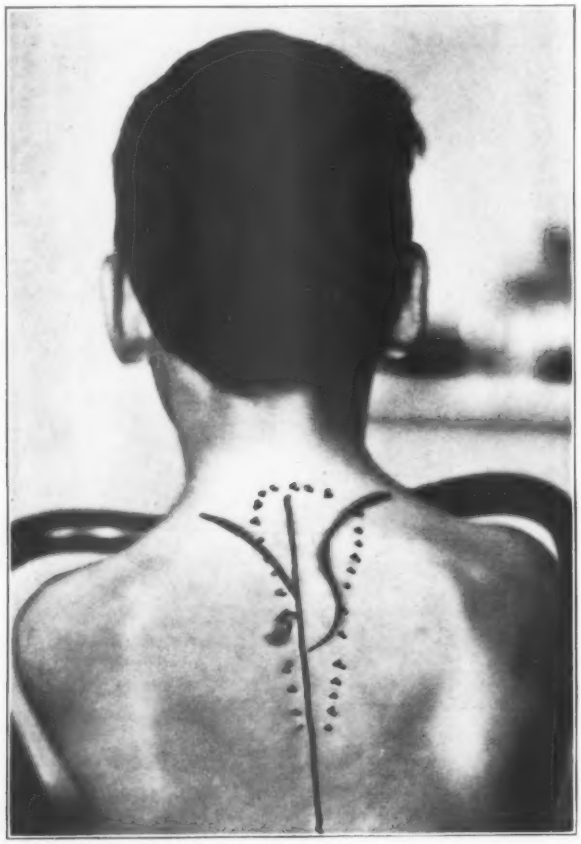

Fig. 7.—As in the two preceding pictures the dulness is indicated by the continuous line, the bronchophony by the dotted one.

He has known intubation to have been performed under the belief that the case was one of laryngeal diphtheria. This mistake will not occur if it is recalled that in the latter condition the voice is lost, but present with enlarged glands. D'Oelsnitz[14] has found that with urgent dyspnea from

14. D'Oelsnitz: Bull. Soc. de pédiat. de Paris, 1911, No. 6, 304.

an enlarged thymus the inspiratory retraction below the diaphragm and above the sternum and clavicle is about equal, but that when enlarged tracheo-bronchial nodes are the etiologic factor, the subdiaphragmatic retraction greatly exceeds that at the superior thoracic aperture. The simultaneous retraction in the epigastrium, the lower sternal region and in both hypochondria seeming to make the upper part of the chest bulge forward with inspiration.

Dyspnea in adults without adequate pulmonary, cardiac or renal lesion should make one think of enlarged mediastinal glands as a possible cause.

Fig. 8.—Marked interscapular dulness in a patient with mitral stenosis and regurgitation and secondary tricuspid insufficiency. No whispered bronchophony.

In a patient of Hoover's,[7] with aortic aneurism in whom attacks of dyspnea were extreme, a marked degree of neuritis of the vagus was found at autopsy. Figures 10 and 11 show how far the nerve may be displaced from its normal position by the swollen nodes.

Hemorrhages may take place as the result of erosion of a blood-vessel from pressure, and fatalities have occurred in some instances. More common is the expectoration of smaller amounts of blood. The way in

which this is brought about was described so admirably by Coley[15] in an excellent article over sixty-five years ago on bronchial-node tuberculosis that I will quote him verbatim:

> When the return of blood from the head is obstructed by a considerable enlargement of the bronchial glands, and innutrition and enervation have been rapidly advancing, a sudden impulse given to the circulation by passion or otherwise may occasion a copious extravasation of blood from the venous capillaries into the pulmonary or bronchial mucous membrane which may leave behind it no other lesion than an appearance of ecchymosis.

In substantiation of which he cited a case reported by Barthez and Rilliet,[16] in which there was congestion at the tracheo-bronchial junction. Griffin[17] likewise reported intense hyperemia of the trachea at its bifurcation, associated with enlarged and caseous nodes, in a man of 28, who died with the symptoms of hemorrhage. I have had under observation a boy who has expectorated blood several times, and both physical examination and the *x*-ray show enlargement of the bronchial nodes, but no pul-

Fig. 9.—1, Trachea. 2, Left bronchus. 3, Glands along trachea above right bronchus. Whispered voice present over upper four thoracic spines.

monary involvement. Dr. Lewis G. Cole tells me he has made radiographs of several similar cases. It is my belief that signs of bronchial-node enlargement will usually be found in the patients who have hemorrhages without evidence of pulmonary or cardiac lesion. Paralysis of the vocal cords (usually the left) is suggested by a hoarseness of the voice, while the unilateral dilatation of the pupil — an uncommon sign — points to pressure on the sympathetic. Sometimes one can observe a delayed expansion of one side, even without pulmonary involvement. Palpation, though greatly inferior to percussion and auscultation, is sometimes of

15. Coley: A Practical Treatise on the Diseases of Children, 1846, p. 185.

16. Barthez and Rilliet: Traite de malad. des enfans., iii, 172, quoted by Coley (Note 15).

17. Griffin: Med Rec., New York, 1891, xxxix, 166.

considerable value. Tenderness to pressure over the mid-thoracic spines to which Petrushky[18] called attention some years ago, is present in children and also in adults when the toxic symptoms of tuberculosis are marked, but it is not found in the latent cases nor in those in the

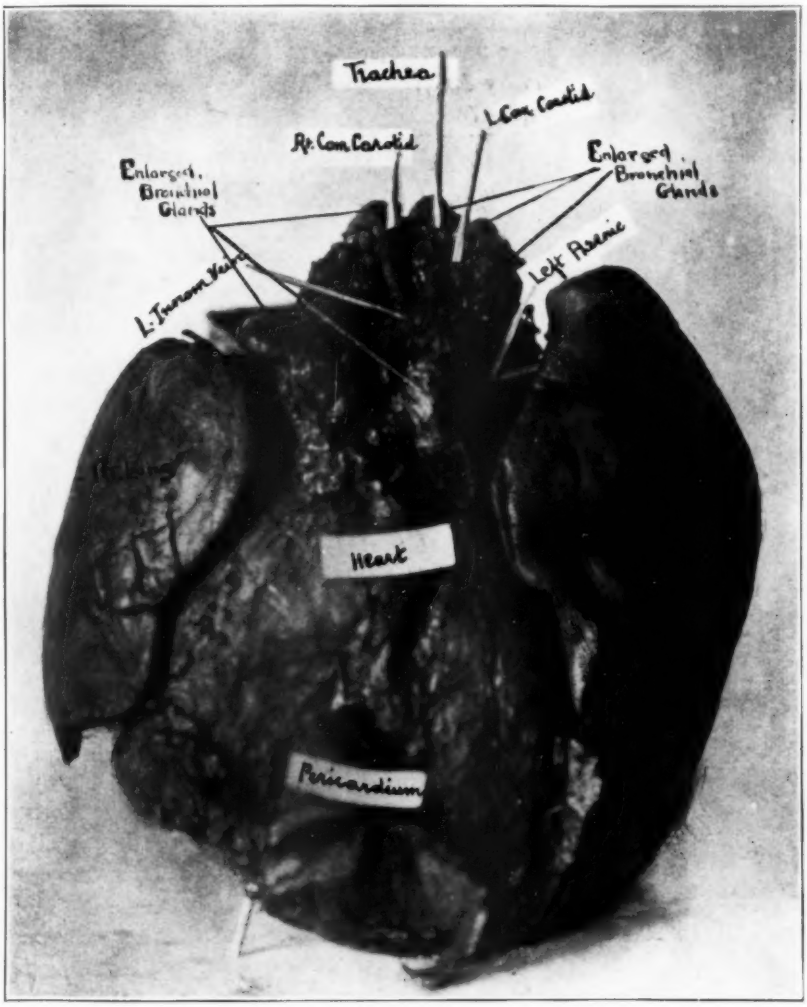

Fig. 10.—Anterior view of the mediastinal contents from a case whose only constant physical sign during life was whispered bronchophony in the interscapular space. Upper part of right lung has been resected.

advanced stages, and both rest and tuberculin treatment cause its prompt disappearance. Spinal tenderness of neurasthenia is not limited to the

18. Petrushky: München. med. Wchnschr., 1903, i. 364.

upper thoracic vertebra. De la Camp[19] found spinalgia in 87 per cent. of 100 incipient cases. He states that the pain is present with recent inflammation, but not with cheesy nodes. Unless the tenderness is definite it is not of significance. The change of facial expression and the approximation of the scapula when the tender spines are palpated, are the most significant evidence. Tenderness to deep palpation along the sides of the neck just below the larynx is probably an indication of vagus hypersensitiveness induced by the pressure of enlarged nodes. Dautwitz[20]

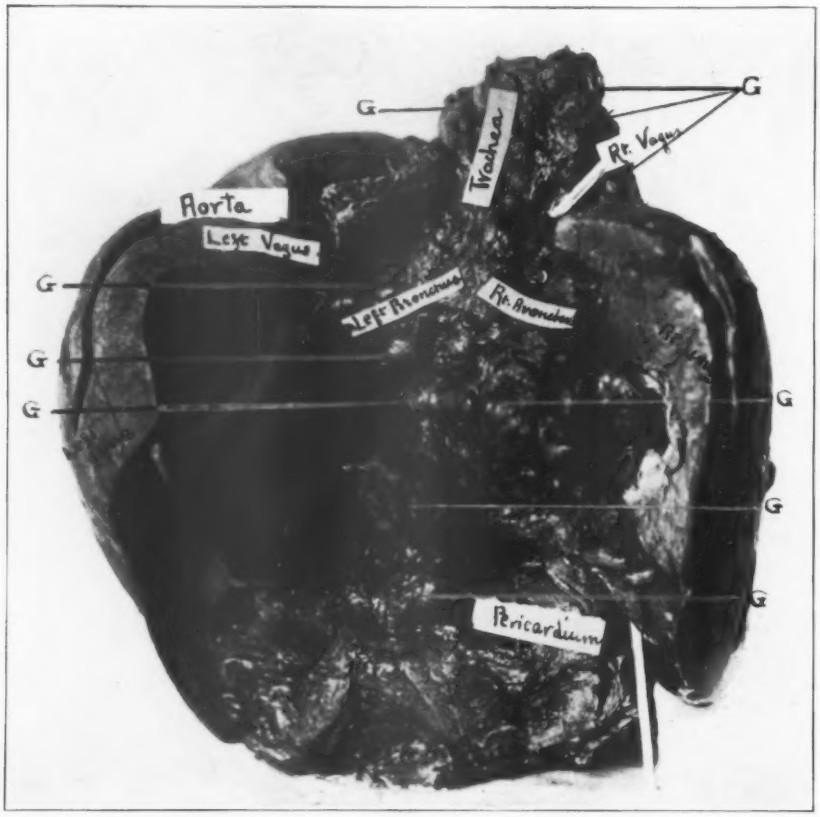

Fig. 11.—Posterior view of the thoracic viscera of patients referred to in text of Figure 10. Glands indicated by G. A large part of both lungs have been removed.

lays particular stress on the tenderness elicited by pressure over the sternoclavicular junction. The pain so occasioned may extend to the shoulder.

19. De la Camp: Quoted by Nagel, Jahrb. f. Kinderh., 1908, lxviii, 46.
20. Dautwitz, Beiheft z. med. Klin., 1908, iv, No. 9.

PERCUSSION

The bronchial lymph-nodes lie so deeply that on first consideration it would seem quite unlikely that enlargement thereof could be detected by means of percussion. That this is often possible I am confident, providing, however, that a definite plan be followed in the examination and

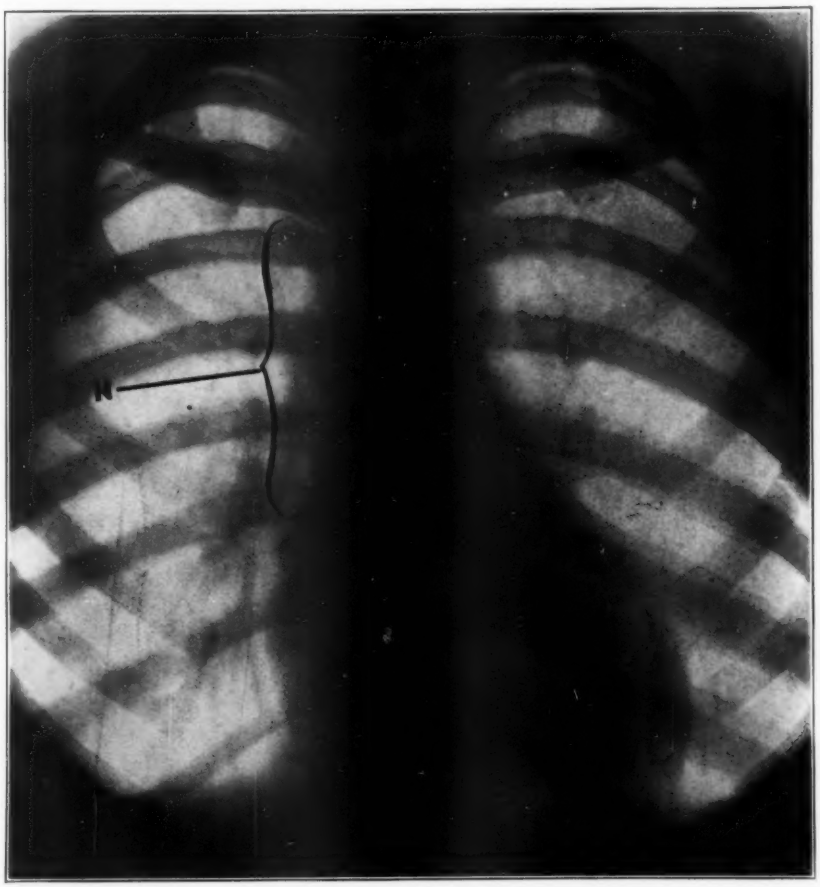

Fig. 12.—W. E. (216). This patient presented no signs of bronchial gland enlargement, and was twice negative to the skin tuberculin test. Lungs well aerated, except at both apices, where a suggestion of mottling is to be seen. A few calcareous hilus glands seen to the right of the heart. One should observe the normal contour of the right border of the heart (N). The subsequent pictures of patients with bronchial glands show a distinct bulging from the third space upward on the right of the vertebral column.

the percussion be sufficiently delicate. Notwithstanding that practically all articles dealing with physical diagnosis state that light percussion is more valuable than heavy, the majority of physicians percuss too hard.

If we digress for a moment to consider briefly the physics of percussion, the advantage of the light method will be apparent. When a blow is struck on the surface of an object, the area caused to vibrate is within a cone whose apex is at the point struck. The energy of percussion tends to be propagated in a line perpendicular to the surface and the diameter of the cone at its base bears a direct relation to the force of the blow. Let us apply these principles to Figure 4 (from Northrup), of an antero-posterior section of the lung, showing marked enlargement of the bron-

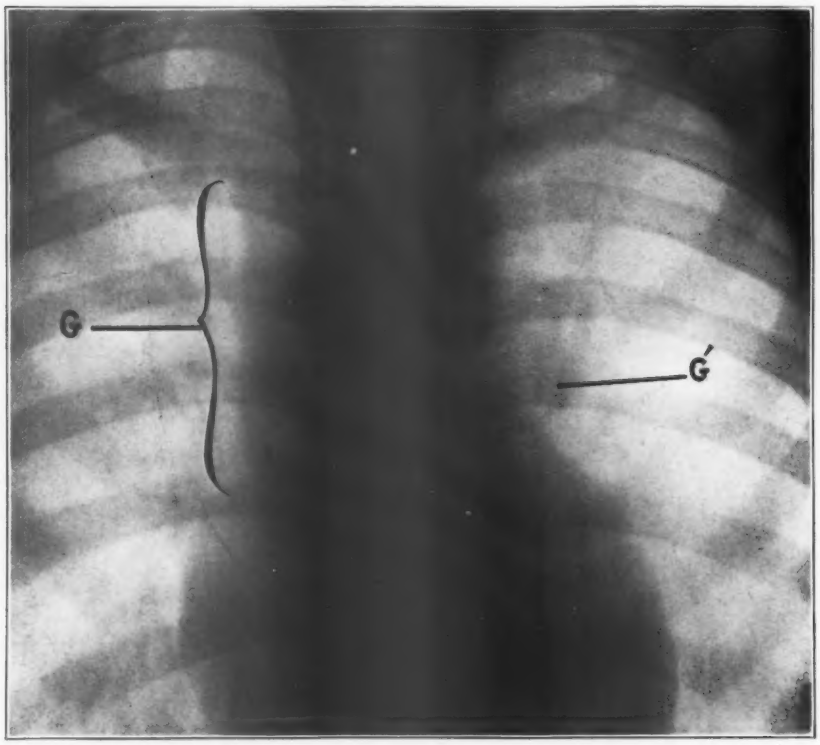

Fig. 13.—A. H. (209), aged 11. Retraction above right clavicle, and diminished expansion at right apex. Dilated veins over the front of the chest. Tender over fifth thoracic vertebra, less so over the upper four thoracic spines. Dulness to the fifth thoracic vertebra. Vertebral bronchophony, negative when first examined but later well marked. Tuberculin test negative. *X*-ray diagnosis: Normal markings of lungs show distinctly. Heart normal in size and position. Deficient aeration of and mottling of right apex. Enlarged bronchial glands, extending from the first to the third rib on the right (G), and on the left, opposite the cartilage of the second rib (G′).

chial nodes. The line *A-A* represents the skin surface. In the triangle with dotted lines (*D, C, D*), which represents light percussion, all the sound waves are obstructed by the bronchial nodes and a dull note is

obtained. Heavy percussion is indicated by the triangle with the dot and dash line (*C, C, C*) and the dulness will be imperceptible, as so many of the sound waves pass by into the resonant lung. The futility of employing strong percussion for deep-lying lesions is thus apparent. While the triangle with dotted lines (*D, C, D*) depicts satisfactory percussion for the large lymph-nodes here shown, it would be too hard if only node *X* were present. On the other hand, much light percussion, shown by the triangle with the continuous line (*E, C, E*), would reveal

Fig. 14.—Hodgkins' disease. Edema of chest wall, arms neck and face. Marked substernal dulness. Paravertebral dulness slight. Whispered bronchophony marked over sternum and to a less extent in interscapular space. Normal markings of mediastinum obliterated by the huge mass of glands. Note "mushy" appearance.

this, and be equally as satisfactory when the nodes were of the size here shown.

In order that the percutorial energy may reach the deep-lying object, a certain force is necessary, and the arc of a circle with a continuous line

(2), represents the essential penetration. While the depth is somewhat increased with the force of the blow—arc with broken line (3)—it does not increase in proportion to the width, as the triangle with the dotted line (*C, C, C*) shows. Arc 1, depicts percussion too light to reveal node *N*, but sufficiently strong for a lesion at point *B*. In order to determine how forcible a blow is required in a given case, Turban[21] suggests percuss-

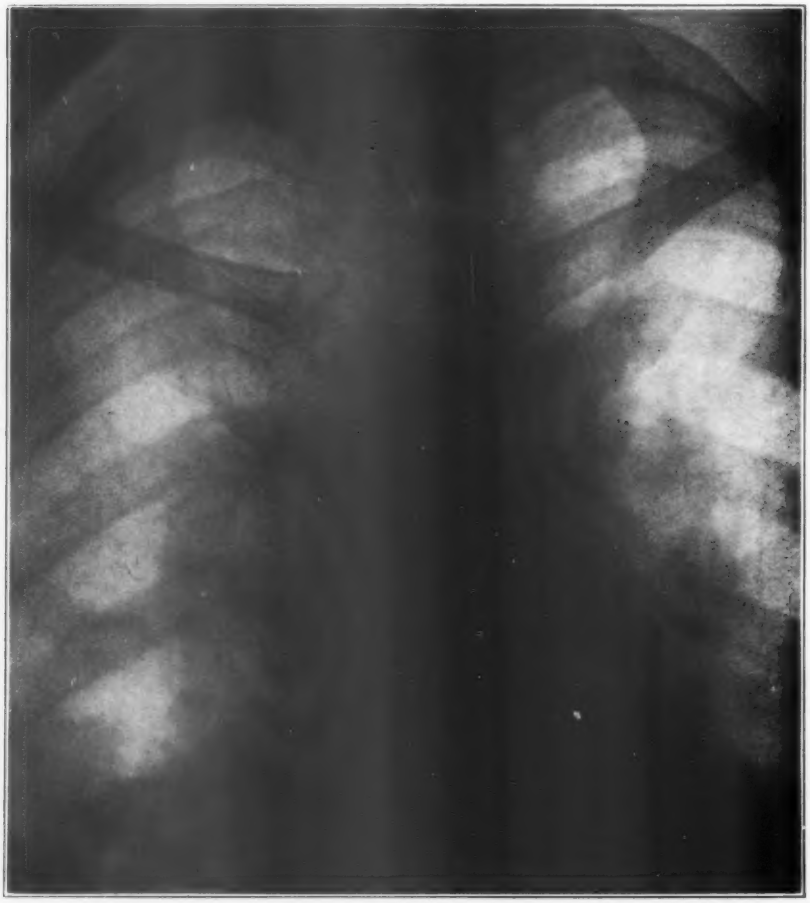

Fig. 15.—Male patient, aged 49, with signs of very early infiltration at right apex. Vertebral and paravertebral dulness and increased whisper were present in the interscapular space. The radiogram shows great increase in size of central shadow, the normal markings of which are obliterated. Transverse diameter of the root of the lungs markedly increased, and in the *x*-ray plate a deficient aeration of the right apex is shown. Twice negative to the von Pirquet tuberculin test, he subsequently reacted positively to the subcutaneous test. Owing to a general lymphatic enlargement it is quite likely that he had Hodgkins' disease. The mediastinal shadow resembles the one in Figure 14.

21. Turban: The Diagnosis of Tuberculosis of the Lungs, New York, 1906, p. 69.

ing thrice on the same spot, first lightly, then slightly more forcibly and finally employing Ebstein's[22] "touch percussion," which is merely a tapping with the middle finger of the right hand without wrist motion on the terminal phalanx of one of the fingers of the left hand, the little finger being the one of choice, as it causes the smallest amount of surface vibration. Turban has frequently demonstrated at autopsy nodules indicated during life by Ebstein's percussion when other methods were

Fig. 16.—Radiograph of child shown in Figure 5. B indicates cross section of a bronchus and small glands are shown at G.

doubtful. I thoroughly agree with Turban that this tapping percussion is greatly to be preferred in children and in adults with poor muscular development and with but little subcutaneous fat. It is not applicable,

22. Ebstein: Berl. klin. Wchnschr., 1894, Nos. 26 and 27. Quoted by Turban (Note 21).

on the other hand, in the obese, or in the presence of great muscular development. The following method of eliciting bronchial node dulness has been found satisfactory:

The patient seated on a stool in front of the examiner, who is also seated, crosses his arms over his chest, the fingers passing to the posterior axillary fold of the opposite side. To secure relaxation of the spinal muscles, which when contracted, give a dull note, the cervical and upper

Fig. 17.—The mottled appearance along the descending branch of the right bronchus (seen to the right of the heart) probably due to the tuberculous peribronchial infiltration. The physical signs in this patient are shown in Figure 6.

thoracic vertebra are slightly flexed. Too great flexing must be guarded against, as it diminishes somewhat the area of bronchial gland dulness, though just why is not clear. The upper inner border of the lung as outlined by König's method, curves up to the side of the vertebral column at a point opposite the inter-articular cartilage between the second and third thoracic spines, but with enlargement of the tracheal

glands this normal curve is displaced outward and may not reach the vertebra until the fourth or fifth dorsal (Figs. 5, 6 and 7). When dulness extends outward from the fifth or sixth thoracic vertebra, it is probable that the bronchial and hilus nodes are enlarged. Bing[23] believes he is able to detect a normal dulness at the root of the lung opposite the fifth thoracic spine, the area being slightly larger on the right than on

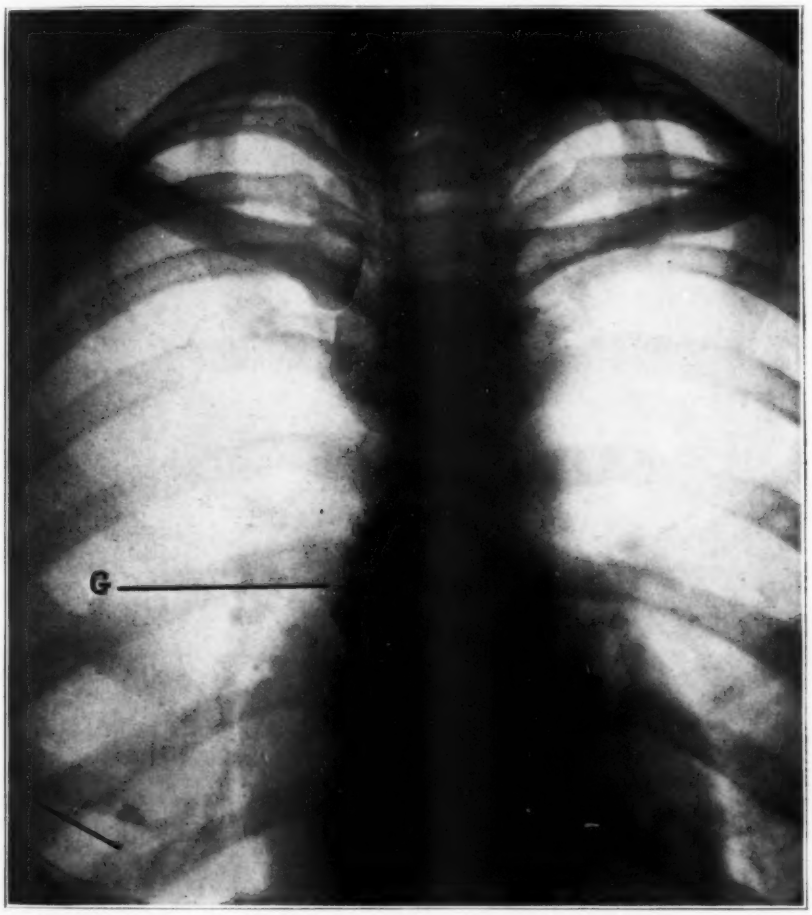

Fig. 18.—Adult woman. Infratracheal gland is shown at G. The bulging from peritracheal nodes is not present. At I is a small area of infiltration. The chief physical signs were exquisite vertebral tenderness over the upper thoracic vertebra, slight dulness in the second interspace to the right of the sternum, vertebral dulness to the fifth thoracic vertebra and paravertebral dulness opposite the fourth or fifth thoracic. Vertebral bronchophony was present but not well marked.

23. Bing: Ugesk. f. Læger, 1910, lxxii, 199. Also Berl. klin. Wchnschr., 1910, xlvii, 376.

the left. I have been unable to confirm this. Not only should the resonance of the two sides be compared, but one should percuss each side from above downward, from below upward, from within outward and without inward. The outer border of dulness is the most difficult to determine. A blue pencil should be employed, and verifying one's markings with the eyes closed is an excellent way to determine one's percutorial ability. As Figures 1 and 2 show, the nodes are more numer-

Fig. 19.—Adult woman. Paravertebral and vertebral dulness to the sixth thoracic vertebra. Whispered bronchophony very marked and heard over the whole of the posterior aspect of the thorax. Note increased width at the root of the lungs, to the right of the vertebral column in first and second interspaces. Considerable increase in the right hilus shadow is seen in the third interspace. The right oblique position showed post-cardiac glands.

ous to the right, and for this reason the dulness is often limited to the right, and when bilateral, is usually more marked on that side.

In an endeavor to determine how large a node must be to be detected percutorially, Krämer[4] injected wax into a cadaver just anterior to the vertebra, and found that when it was in the trachea or beneath the pleura

he could obtain dulness with 15 c.c., but not with 10 c.c. It seems quite probable that the bronchial glands are not alone responsible for the dulness. Nagel[19] believes that there is an actual lessening of the amount of lung tissue as the result of the displacement caused from the glands. Krämer[4] is of the opinion that the engorgement of both the lymph and blood-vessels as the result of obstruction at the hilus is responsible for a considerable amount of the dulness, and he draws attention to the fact that the *x*-ray does not show as large glands as might be expected from the extent of the dulness. Phillippi,[5] on the other hand, thinks that the stasis in the lymph and blood-vessels plays an insignificant part, and he considers an inflammatory condition of all the hilus structures as the chief factor. That this is probably near the truth, the operative observation of Veau[24] shows. He operated on a patient with urgent dyspnea with a view of performing a thymectomy, but found only enlarged tracheobronchial nodes and a general mediastinitis. It is quite probable that all the above-mentioned factors contribute more or less to the dulness.

With slight apical involvement an area of normal resonance may be present between the dulness from the pulmonary lesion and that of the bronchial nodes. Von Koryni,[25] Ewart,[26] De la Camp[27] and De Costa[28] consider vertebral percussion superior to paravertebral. In adults a dull note is present normally over the first four dorsal spines. Ewart states that the fifth spine is normally dull, but this I think questionable. A distinctly dull note below the fourth spine is abnormal and may be indicative of mediastinal glands. In young children a resonant note is obtained over the fourth thoracic and not infrequently over the third. Because of the diminutive size of the spinous processes in the very young and their close proximity vertebral percussion is more difficult to perform than paravertebral. The absence of vertebral dulness has little weight in excluding bronchial node enlargement as it occurs much less frequently than paravertebral dulness. It is more apt to be present when the paravertebral dulness is bilateral.

Three children with mitral regurgitation and one with mitral stenosis and regurgitation with secondary tricuspid insufficiency had dulness in the interscapular space. It would seem that the dulness in these cases was due to dilatation of the left auricle, which the frozen sections of Fetterolf and Gittings[29] show is the most posterior chamber of the heart.

24. Veau: Bull. Soc. de pédiat. de Paris, 1911, No. 2, 83.

25. Von Koryni: Handb. d. spec. Path. u. Therap., 1897, iv, 717. Quoted by De la Camp (Note 19).

26. Ewart: Lancet, London, 1899, ii, 261.

27. De la Camp: Ergeb. d. inn. Med. u. Kinderh., 1908, 556.

28. De Costa: Am. Jour. Med. Sc., 1909, cxxxviii, 815.

29. Fetterolf and Gittings: Am. Jour. Dis. Child., 1911, i, 6.

The right auricle undoubtedly contributed to the dulness in the case of tricuspid insufficiency. The extent of the dulness varied at different examinations, which is quite consistent with what we know concerning the dilatation of the auricle. In these cases it was at a somewhat lower level than the dulness from bronchial nodes (Fig. 8).

It is much less common to obtain dulness from the bronchial nodes anteriorly. When the nodes about the right bronchus are of considerable size, it is sometimes obtained in the second right space near the sternum. If the tracheal glands are much swollen, a dull note may be detected in the first space, just to the right of the sternum and possibly over the right half of the manubrium sterni. The slight dulness often present in the first right interspace near the sternum is due, according to Fetterolf and Norris,[30] to the more anterior position of the large vessels of the right side and to a relatively smaller amount of pulmonary tissue. Sternal dulness in children is nearly always due to an enlarged thymus, which may persist, Dautwitz states,[20] to the twelfth or thirteenth year. This thymic dulness usually extends to the left in the first interspace for a centimeter or more. Boggs[31] has drawn attention to the fact that the lower border of thymic dulness moves upward when the head is markedly extended. Whether this occurs with bronchial nodes, I do not know. The possibility of an enlargement of the thyroid wholly intrathoracic in character should be considered with substernal dulness in adults. Proof that this may occur comes from the Mayo Clinic. The symptoms of hyperthyroidism and early tuberculosis, moreover, have much in common. It is frequently stated that in early lesions, with right apical diseases, there may be an increase of cardiac dulness to the right as a result of the lateral displacement of the anterior border of the right lung which is attributed to the contraction at the right apex. It is more likely that this dulness is due to bronchial node enlargement.

In addition to anterior and posterior percussion, Bing[23] outlines the apices according to Goldscheider, whose method differs from König's, in that he percusses in sagittal lines, i. e., parallel with the vertebral column, and he finds that enlargements of the bronchial nodes cause a narrowing of the normal resonant isthmus at the extreme summit of the lung, due to external dislocation of the inner border of normal resonance. This method of percussion requires much greater skill than either the anterior or posterior method and the dulness so obtained is certainly infrequent with nodes but slightly enlarged. Bing believes that the slight degree of apical dulness sometimes met with in children with adenoids is due in reality to enlarged bronchial nodes rather than to the induration collapse to which it is commonly attributed.

30. Fetterolf and Norris: Am. Jour. Med. Sc., 1912, cxliii, 637.
31. Boggs: Arch. Int. Med., 1911, viii, 659.

AUSCULTATION

As with the lungs and heart, so with the bronchial nodes, ascultation is our most valuable method of examination. There is nothing characteristic in the respiratory murmur over the lungs with moderate enlargement of the bronchial nodes. Normal breath-sounds are the rule. As the nodes become larger the vesicular equality diminishes and is sometimes entirely replaced by tubular breathing usually most marked in the interscapular space. Again with very large nodes the breathing may be diminished owing to the small amount of air entering the lung. In one instance I noticed a diminution of the respiratory murmur associated with an increased whisper. Several years ago D'Espine[32] drew attention to the fact that in children whispered bronchophony normally ceased at the seventh cervical vertebra, but that with enlargement of the bronchial nodes it extended downward over the upper thoracic. D'Espine has had several post-mortem confirmations of the trustworthiness of this sign. The occasional occurrence of bronchophony in the interscapular space was noted by Laennec[33] in *"lean children,"* but he apparently did not appreciate its significance. D'Espine suggests auscultating over the upper thoracic spine while the patient whispers "three-thirty-three." In young children I found this sentence rather involved, so I substituted the word "tree," which is repeated three times (*tree, tree, tree*). If the bell of the stethoscope is placed directly over the lower cervical spines and the patient whispers this sentence, one observes that the final "e" persists for an appreciable time after the voice has ceased. Only this post-phonal sound is of significance; the mere persistence of vocal resonance is not. As has been said, this normally does not occur below the cervical vertebræ in children, and in adults it usually stops at the same level, but with a sonorous voice it may apparently persist as low as the third or fourth thoracic vertebræ without significance, unless it is marked and heard at one or both sides of the vertebræ. The area over which the whispered voice may be heard varies greatly. Sometimes it is limited strictly to the vertebral spine, but usually it extends to one or both sides. Frequently it is heard as far out as the border of the scapula and quite often it follows the line of the left bronchus. Twice in adults I have heard it as low as the sacrum. In another adult it was so marked to the left of the upper thoracic vertebræ that except for the absence of râles a cavity was suggested. In this case it eventually completely disappeared. Two patients in whom I had noted this sign have come to autopsy. In one, a woman of 66, the sign was present over the upper fourth thoracic vertebræ and also slightly to the right thereof. The expiration was also

32. D'Espine: Bull. de l'acad. de méd., Paris, 1907, lvii, 167.

33. Laennec: Epoch Making Contributions to Medicine, Surgery and the Allied Sciences, Camac, Philadelphia, 1909, p. 125.

somewhat increased at the right apex. No lesion was found at either apex, but there was an enlarged node about the size of an English walnut just above the right bronchus (Fig 9). In the other case, an adult male, the increased whisper was heard throughout the interscapular space and was most marked at the left to the mid-thoracic vertebræ. A few scattered tubercles were found in the lung and the marked enlargement of the bronchial nodes is shown in Figure 10 and Figure 11. Strong flexion of the head will sometimes increase this sign. One possible explanation of the whispered bronchophony is that the bronchial quality of the voice is conducted to the vertebræ by the swollen glands and when heard to the side is due to rib conduction. It is quite likely, however, that the transmission may sometimes be a direct one. Increased vocal resonance is normally present over the manubrium sterni, but when the anterior group of nodes are swollen whispered bronchophony may be very marked. It was present both anteriorly and posteriorly in a recent case of probable aneurism of the arch of the aorta, due presumably to pressure on the trachea. In infants the character of the cry is substituted for the word "three." In several elderly people with a chronic cough which was subsequently proved to be tuberculosis, I found the whispered bronchophony very marked. Gray[34] was the first in this country to call attention to the value of this sign. In a former paper[35] I reported whispered bronchophony in eighty out of 168 children. Sixty-six per cent. of those in whom it was present reacted to tuberculin as against 25 per cent. of the others. Since then seventy-five other delicate children have been examined and tuberculin-tested. Whispered bronchophony was present in a little over one-half of the cases, and in these over 79 per cent. gave a positive reaction, while but 50 per cent. of those not giving the sign reacted positively. Whispered bronchophony was sought for in 266 office patients—all adults—most of whom had some symptoms suggestive of tuberculosis. These cases were classified as follows: Active tuberculosis (mostly very early cases), 43 per cent.; latent tuberculosis (healed), 8 per cent.; suspected tuberculosis, 24 per cent.; non-tuberculous, 24 per cent. It was present in 84 per cent. of the active cases and 83 per cent. of the latent; 72 per cent. of the suspected cases and 43 per cent. of the clinically non-tuberculous. If only the cases in whom the sign was very marked at the sides of the vertebræ as well as over the spines had been included in this last group, the percentage would have been considerably less.

It is interesting to compare these auscultatory results with the percutorial results of Bing[23] and Gunmach.[36] The former found inter-

34. Gray: Proc. Nat. Assoc. for Study and Prevent. of Tuberculosis, 1908, iv, 300.

35. Stoll, H. F.: Am. Jour. Med. Sc., 1911, cxli, 83.

36. Gunmach: Quoted by Krämer (Note 4).

scapular dulness in 75 per cent. of his tuberculous cases, while Gunmach obtained it in 80 per cent. Roch[37] investigated the value of this sign in adults and concluded that it was of a great deal of significance when heard over the midthoracic region, but of questionable value when not heard below the level of the third or fourth thoracic spines. A note of dissent comes from Kidd,[38] who asserts that interscapular dulness is never present unless the lung is affected, and from the examination of fifty-one patients, mostly adults, he concludes that whispered bronchophony is not a trustworthy guide as to the size of the bronchial nodes. Inasmuch, however, as he considered the sign positive in adults when present only over the second or third thoracic spines, his dissension loses much of its weight.

The venous hum heard over the manubrium sterni when the head is strongly extended and described by Eustice Smith[39] as being indicative of enlarged tracheo-bronchial nodes, does not seem to be a sign of much value.

Material weight is lent to the diagnosis of bronchial node tumor when both dulness and bronchophony are present. But from the physical signs alone the nature of the swelling cannot be determined. Even when the tuberculin test is positive, we have to fall back on the symptoms to ascertain whether we are dealing with clinical tuberculosis, which needs immediate treatment, or only an anatomic lesion which requires temperance in all things.

THE X-RAY

(Drs. A. C. Heublein, O. R. Witter and H. F. Stoll)

We will first consider the shadows produced by the normal thoracic viscera before describing those of the swollen lymph-nodes. The large central shadow has been likened by D'Oelsnitz[14] to a bottle (or distillatory flask), the body being caused by the heart and the neck by the vertebral column and mediastinal contents. The hilus shadow is fan-shaped and radiates from the central shadow for about 4 cm. to the right of the fifth, sixth and seventh thoracic vertebræ. This is caused by the wall of the stem bronchus, the pulmonary vessels with their contained blood, the lymphatic and fibrous tissue. Fine markings, due to the bronchial walls, blood-vessels and lymphatics are seen in the lung fields radiating toward the periphery. Slightly to the right of the vertebral column between the heart and the clavicle, one normally sees a faint veil-like shadow about 1 cm. wide (Fig. 12 "N"). Dunham and Boardman[49] demonstrated that the superior vena cava played an important part in its protection. In the case of mitral stenosis with tricuspid insufficiency already referred to,

37. Roch: Semaine méd., 1911, xxxi, 85.
38. Kidd: Lancet, London, 1911, i, 561.
39. Smith: Wasting Diseases of Childhood, London, 1899, p. 309.

this shadow was considerably widened, especially at its lower end where it joined the cardiac outline. This substantiates their contention. The consensus of opinion as to the ability of the *x*-ray to show bronchial nodes is as follows: Normal glands never cast shadows; calcified glands always do; cheesy glands almost always do. Swollen, but not cheesy, glands usually do. As a result of the comparison of the physical signs with the *x*-ray plate in over seventy-five cases which Drs. A. C. Heublein and O. R. Witter were kind enough to take for me, we have concluded that, as a rule, the earliest *x*-ray evidence of enlarged bronchial nodes is a shadow seen to the right of the vertebral column. It is in the position normally occupied by the superior vena cava, but is of greater density and protrudes further into the lung field. This shadow extends from about the tip of the third cartilage upward toward the clavicle and gives an increased width to the root of the lung. The lower border may terminate at the heart, or it may be seen through the cardiac shadow extending to a somewhat lower level (Fig. 13). By consulting Figure 1 it will be seen that this region just to the right of the sternum and vertebræ is occupied by the trachea, the peritracheal nodes and the nodes just above the right bronchus. When the enlargement is small, no individual glands are seen, the only thing being noted is the increase in the transverse diameter at the right of the lung already referred to. It is quite likely that the engorgement of the lymph and venous trunks from the pressure of the glands contributes to this shadow. When the nodes attain greater size, the shadow may assume a lobulated appearance (Figs. 14 and 15). The next most common change is seen in the hilus shadow which is enlarged, more dense and may show individual nodes (Fig. 16). They may be of indefinite outline and of little density, or very opaque when calcareous. There may be an increase of the bronchus shadow with no definite hilus glands (Fig. 17). We have rarely seen the infratracheal group in an antero-posterior view because of the intervention of the cardiac shadow. They can be seen, however, in Figure 18. The nodes along the left bronchus are also revealed with difficulty save when calcareous, because of their position behind the heart. It is for this reason that the right oblique position should be used, as the post-cardiac glands will then be seen between the heart and the vertebral column. The heavy trunks which radiate from the hilus shadow are usually seen, but we can give no opinion as to the interweaving of the fine linear markings in the periphery of the lung-fields as described by Dunham and Boardman,[40] as facilities were lacking for making stereoscopic radiographs at the time this investigation was undertaken. We have observed, however, that clouding of the apices may antedate by some time the development of tubercles.

40. Dunham and Boardman: Bull. Johns Hopkins Hosp., 1911, xxii, 229.

From our experience we conclude that the *x*-ray is of great value in detecting bronchial node enlargements. The healed nodes are recognized by their small size and dense shadow. We feel that the *x*-ray cannot distinguish between actively tuberculous glands and those in which the disease is "latent."

We have had no experience with the radiographic appearance of the enlarged thymus but the work of Dr. Selby at the Mayo Clinic, and Ferrand and Chatellin,[41] and of D'Oelsnitz[14] in France, leave no doubt as to its value. As a rule, the thymus shadow is predominantly on the left side and does not have the lobulated appearance often seen with enlargement of the bronchial nodes. The shadow of the intrathoracic thyroid begins at about the upper border of the second costal cartilage, and as it extends upward it widens out. This should not be confused with the shadow of either bronchial nodes or enlarged thymus.

The fluoroscopic examination is very valuable, but does not afford a permanent record capable of careful study.

CONCLUSIONS

1. A moderate enlargement of the bronchial nodes often gives physical signs of sufficient distinctness to render their diagnosis possible by clinical methods alone.

2. The signs are usually most marked in the interscapular space.

3. Tapping percussion will elicit bronchial node dulness that is imperceptible when more force is used.

4. Whispered bronchophony in the interscapular space is the earliest and most valuable sign of swollen bronchial nodes. It is especially significant in children and has almost, if not quite, the same importance in adults.

5. While the spasmodic, brassy cough is quite typical of bronchial node tumor, the diagnosis must sometimes be made in the absence of the cough.

6. An ever-present fatigue, associated with anorexia, afternoon temperature and possibly a slight loss of weight should suggest the possibility of their tuberculous nature.

41: Ferrand and Chatellin: Bull. Soc. de pédiat. de Paris, 1911, No. 4, 164.

A GRAPHIC CHART METHOD OF STUDYING AND TEACHING THE PRINCIPLES OF INFANT FEEDING

WITH SPECIAL REFERENCE TO THE IMPORTANCE OF THE ENERGY LINE *

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I wish to present a method which I have been using with considerable satisfaction in teaching the principles of infantile nutrition, a graphic chart method which supplements previous instruction. The chart is simple, easily understood and records the weight variations, the energy line, which indicates how much food the infant needs, the food blocks, which show how much food has been given and retained, and presents a graphic representation of the number and character of the stools. Various other happenings of the day can also be indicated. Thus the chart forms a complete summary of the case for each day. A few explanations will be necessary.

The chart is arranged for daily records for eight weeks with room for a gain of 4 pounds. The spaces between the ordinates represent days, each abscissa represents 2 ounces, between the abscissæ 1 ounce. A gram column parallels the pound column. The calorie column may be started with each abscissa representing either 10 or 20 calories and is usually begun on an even number approximately corresponding to the caloric requirement 1 pound below the entrance weight, in order to allow for weight drops, etc.

Plotting the Energy Line.—This line is constructed from the infant's weight, 45 calories per pound during the first six months of life, gradually declining to 40 or 36 calories during the latter months of the first year.

Plotting the Food Line.—The caloric value of the food is calculated in the usual way. After the student has become thoroughly familiar with this computation he is given a table of the caloric values of one ounce of the various foods used in the ward. (Table 1.) The amount of food in calories ingested and retained is charted. (See Chart 9.)

Charting the Stools.—A series of symbols are used. These may be varied as one desires. The usual ones employed and which the nurses and

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*From the Department of Pediatrics, University of Michigan.
*Read by title at the meeting of the American Pediatric Society, Hot Springs, Va., May, 1912.

students use with readiness are the ones indicated in the stool column. Such combinations of these symbols as the following may be made:

The first symbol indicates a hard stool with curds; alkaline in reaction; the second a liquid stool with curds, mucus and blood; acid reaction; the third an extra sign for any other type of stool.

The chart when completed for the day is a representation of the so-called percentage and caloric methods. Both of which must figure in

TABLE 1.—THE CALORIC VALUE OF ONE OUNCE OF THE VARIOUS MODIFIED MILK FORMULÆ AND FOODS USED IN PALMER MEMORIAL WARD

Formula, Per Cent.			Calories From			
F	S	P	Fat	Sugar	Protein	Total
1	5	0.5	2.79	6.15	0.61	9.55
1.5	5	0.5	4.18	6.15	0.61	10.95
1.5	5	0.75	4.18	6.15	0.922	11.235
1.5	5	1	4.18	6.15	1.23	11.56
1.5	5	1.5	4.18	6.15	1.845	12.17
1.5	5	2	4.18	6.15	2.46	12.79
2	5	0.5	5.58	6.15	0.615	12.34
2	5	0.75	5.58	6.15	0.922	12.05
2	5	1	5.58	6.15	1.23	12.96
2	5	1.5	5.58	6.15	1.84	13.57
2	5	2	5.58	6.15	2.46	14.19
2.5	5	1	6.97	6.15	1.23	14.35
2.5	5	1.5	6.97	6.15	1.84	14.96
2.5	5	2	6.97	6.15	2.46	15.58
3	5	1	8.37	6.15	1.23	15.75
3	5	1.5	8.37	6.15	1.84	16.36
3	5	2	8.37	6.15	2.46	16.98
3	6	1	8.37	7.38	1.23	16.98
3	6	1.5	8.37	7.38	1.84	17.59
3	6	2	8.37	7.38	2.46	18.21
3	5	2.5	8.37	6.15	3.07	17.59
3	5	3	8.37	6.15	3.69	18.21
3.5	5	3	9.76	6.15	3.69	19.60
4	5	3	11.16	6.15	3.69	21.01

Whole milk	21.01
Milk Sugar	13.00
Cow's milk	21.01
Woman's milk	20.5
Skim milk	12.0
Whey	6.0
Buttermilk, approximately	5.0
Precipitated casein, approximately	15.0
Eiweissmilk, approximately	11.0*
Keller's malt-soup, approximately	24.0
Oat flakes, dry, approximately	116.0
Barley flour, dry, approximately	103.0

*The caloric value of *Eiweissmilch* varies 11 and 15 calories per ounce, depending on the percentage of fat in the whole milk and the quality of the buttermilk.

the proper feeding of an infant. There has been so much said about the advantages of one method over the other that I usually begin my work in infant feeding by illustrating the foundation that has been laid in this country by American masters whose names are so familiar to all of us. America has been in no way behind in the development of a knowledge of infantile nutrition. Chart 1 illustrates how closely we have come to the needs of the body as attested by the energy line. I have plotted the weight-curve of a normal bottle-fed baby (taken from Holt) and the maximum amount of food in calories used as a routine by those who follow the percentage feeding scheme. (Arranged from Holt's table.) The gain in weight is seen to follow feeding above the energy line. A chart plotted with the optimum amount of food generally prescribed would bring the food line from 20 to 70 calories above the energy line. It will be seen that infants fed by this scheme have not been underfed, and it should also be stated that the proportion of each food constituent has been carefully adjusted.

TABLE 2.—PROTEIN REQUIREMENTS PER KILO OF BODY-WEIGHT

Age	Required Grams of Protein per		
	Kg. Body-Wght	Pound	Ounce
2 Weeks	1.5	0.68	0.0425
2 Weeks	1.5	0.68	0.0425
3	2.0	0.90	0.056
4	2.5	1.10	0.0687
2 to 12 months ..	2.5-3.3	1.10-1.5	0.093

The most important point to impress on the student is the basic protein requirement of the body. By a previous special study of metabolism as related to infantile growth and development, the student has become acquainted with this basic or minimum protein requirement. He is now taught how to put this into practice by means of the chart. Chart 2 illustrates a simple case. By use of the accompanying table (2) he determines the number of grams of protein required and from this it becomes a simple matter to determine the percentage. He then chooses 5 or 6 per cent. sugar as a constant and makes up the balance of his calories from fat. In the present case the infant has been started on a 2-6-1.5 mixture. The protein has been gradually increased to 1.75 per cent. or 2 per cent. and the fat by steps from 2 to 3 per cent. As the protein is the tissue builder it is placed as the foundation stone in the food block. The daily quantity of food is readily determined as follows:

TABLE 3.—CHART MAKING EXERCISE, BABY A., CASE 1

Date	Weights from Birth		Food from Birth		Stools from Birth
	Pounds	Ounces	Formula	Ounces	
June 1	7	10	.....	..	2 normal
2	..	...	.....	..	2
3	7	8	.....	..	3
4	..	...	6% sugar whey	10	3
5	..	...	.....	..	4
6	7	5	.....	..	3
7	..	...	1½-5-½	20	3
8	..	...	.....	..	1 normal, 1 curd
9	7	8	.....	..	2 normal
10	..	...	.....	..	3
11	7	10	.....	..	2
12	..	...	.....	..	2
13	7	11	.....	..	3
14	..	...	2-5-¾	30	3
15	..	...	.....	..	3
16	7	14	.....	..	2 normal, 1 with curds
17	..	...	.....	..	3 normal
18	8	...	.....	..	3
19	..	...	.....	..	2
20	8	4	.....	..	4
21	..	...	.....	..	2
22	..	...	.....	..	2
23	..	...	.....	..	2
24	8	6	2-5-1	30	2
25	..	...	.....	..	2
26	..	...	.....	..	2
27	8	10	.....	..	3 normal, 1 with curds
28	..	...	.....	..	3
29	..	...	.....	..	2
30	..	...	.....	..	2
July 1	8	14	.....	..	2
2	..	...	.....	..	2
3	..	...	.....	..	2
4	8	14	.....	..	1
5	..	...	2½-6-1	31	1
6	..	...	.....	..	3 normal, 3 with curds
7	8	14	.....	..	2 normal, 1 liquid curds
8	..	...	.....	..	3 with curds
9	..	...	.....	..	2 curd, 1 liquid, with curds
10	8	12	.....	..	2 4
11	..	...	.....	..	6 liquid with curds
12	8	8	.....	27	4
13	..	...	.....	..	3
14	..	...	.....	..	2 with curds, 1 normal
15	8	10	.....	..	3 normal
16	..	...	.....	..	2
17	..	...	.....	..	2
18	9	2	.....	28	3
19	..	...	.....	..	3
20	..	...	.....	..	2
21	9	6	.....	..	2
22	..	...	.....	..	3
23	..	...	.....	30	3
24	9	10	.....	..	2
25	..	...	.....	..	2
26	..	...	.....	..	2

TABLE 4.—CHART MAKING EXERCISE, BABY B., CASE 2

Date		Weights		Temperature		Food		Stools
		Pds.	Ounces	M	E	Formula	Ounces	
July	21	12	12	98.4	98.8	3-6-1½	36	2 normal
	22	..	..	98.	98.6	.....	....	2 normal
	23	..	..	98.2	98.4	.....	....	3 normal
	24	13	..	97.8	98.4	.....	....	2 normal
	25	..	..	98.4	99.	.....	....	3 normal
	26	..	..	98.6	98.6	.....	....	2 normal
	27	13	4	98.4	98.8	.....	....	2 normal
	28	..	..	98.	98.6	.....	....	1 normal, 1 liquid
	29	13	5	98.8	98.4	.....	....	2 liquid, acid
	30	..	..	98.6	99.	.....	....	2 semi-liquid, mushy
	31	..	..	98.	98.8	.....	....	1 semi-liquid, 1 normal
August	1	13	5	98.6	98.8	.....	....	2 normal
	2	..	..	98.	98.6	.....	....	2 hard
	3	13	4	98.4	98.6	.....	....	3 semi-liquid, mushy
	4	..	..	98.	98.9	.....	....	4 semi-liquid, mushy
	5	13	4	98.4	98.8	.....	....	4 semi-liquid, mushy
	6	13	6	98.8	98.6	.....	....	5 semi-liquid, mushy
	7	13	1	98.6	98.4	.....	31½	3 semi-liquid, mushy
	8	12	11	97.6	98.6	.....	....	3 semi-liquid, mushy
	9	12	6	96.8	97.4	.....	....	2 semi-liquid, 1 liquid
	10	12	6	95.	97.6	.....	33	2 semi-liquid
	11	12	8	97.4	98.4	.....	34	1 semi-liquid, 1 normal
	12	12	9	96.4	96.2	.....	34½	2 normal
	13	12	9	96.2	95.6	.....	....	1 hard
	14	12	4	96.2	96.2	.....	....	4 semi-liquid, mushy
	15	12	2	96.	96.6	.....	....	5 semi-liquid, mushy
	16	11	14	95.2	96.6	Tea	....	5 semi-liquid
	17	11	10	96.4	97.4	B. M.	24	3 semi-liquid, 1 liquid
	18	11	11	97.2	97.8	.....	....	4 liquid with curds
	19	11	12	96.8	97.	3-6-1½	25 boiled	4 liquid with curds
	20	11	12	95.8	97.2	.....	....	3 semi-liquid with curds
	21	11	13	97.	98.	.....	....	3 semi-liquid
	22	11	13	98.	98.4	.....	....	2 semi-liquid
	23	12	3	98.	98.4	.....	....	2 semi-liquid
	24	12	9	98.4	98.6	.....	30 boiled	1 semi-liquid, 1 normal
	25	12	13	98.4	98.8	.....	....	2 normal
	26	12	14	98.6*	99	.....	....	2 hard
	27	12	15	....	....	.....	....	2 hard
	28	12	15	....	....	.....	....	2 hard
	29	13	4	....	....	.....	31 boiled	2 normal, 1 hard
	30	13	5	....	....	.....	....	3 normal
	31	13	5	....	....	.....	....	2 normal
Sept'ber	1	..	..	....	....	.....	....	2 normal
	2	13	6	....	....	.....	34½ past	1 hard
	3	..	..	....	....	.....	....	2 normal
	4	13	9	....	....	.....	....	3 normal
	5	..	..	....	....	.....	....	3 normal
	6	..	..	....	....	.....	....	2 normal
	7	13	10	....	....	.....	....	2 normal
	8	..	..	....	....	.....	....	1 hard, 1 normal
	9	..	..	....	....	.....	Fresh	3 normal
	10	13	12	....	....	.....	....	2 normal
	11	..	..	....	....	.....	36 fresh	2 normal
	12	13	14	....	....	.....	....	3 normal
	13	..	..	....	....	.....	....	2 normal
	14	14	..	....	....	.....	....	2 normal
				....	....	.....	....	3 normal

*Temperature normal thereafter. B. M. = Buttermilk.

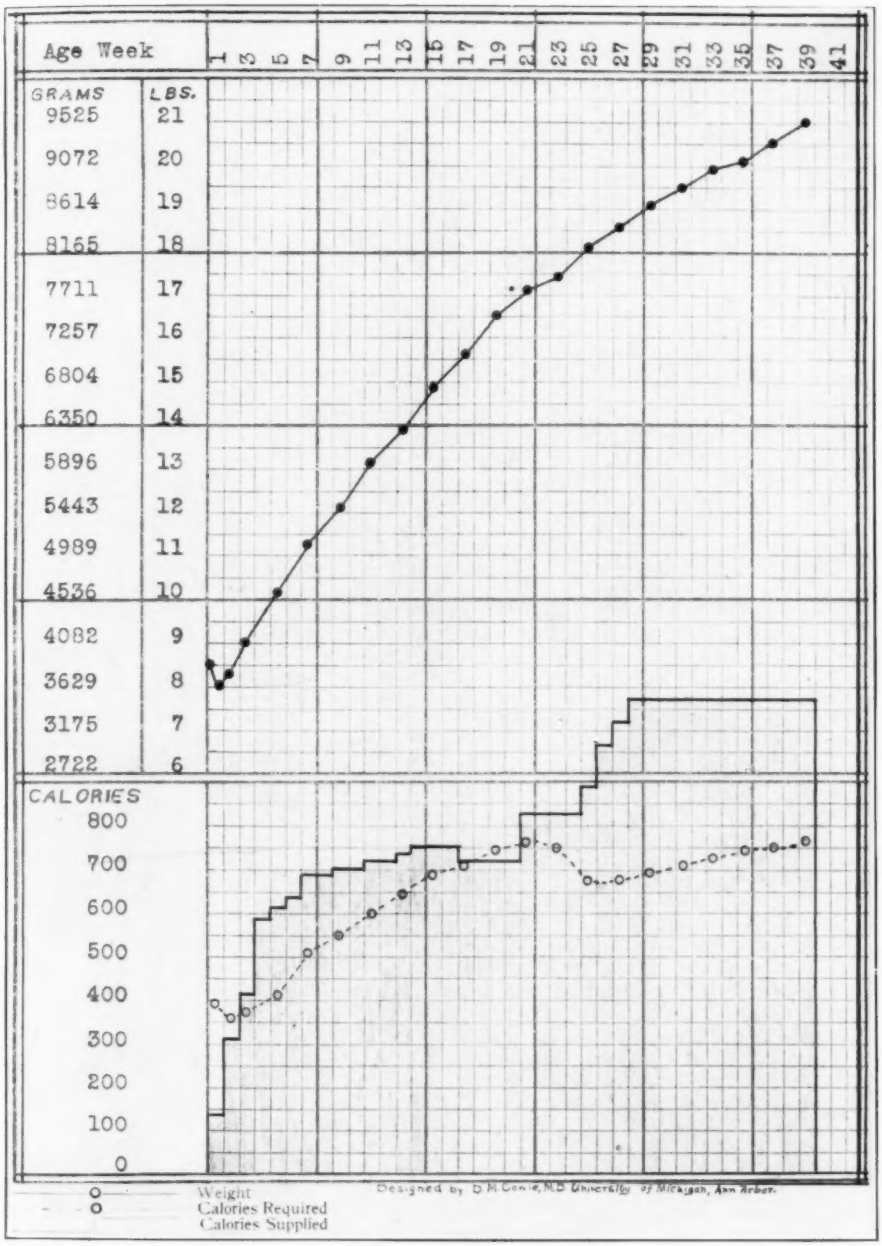

Chart 1.—This chart shows the average weight curve of a normal bottle fed infant, the energy line (calories of food required), and the amount of food (in calories) supplied by the maximum percentage formulæ quite generally employed by pediatricians in the United States. The chart further shows how correctly American children have been fed by the percentage method without reference to the "caloric method."

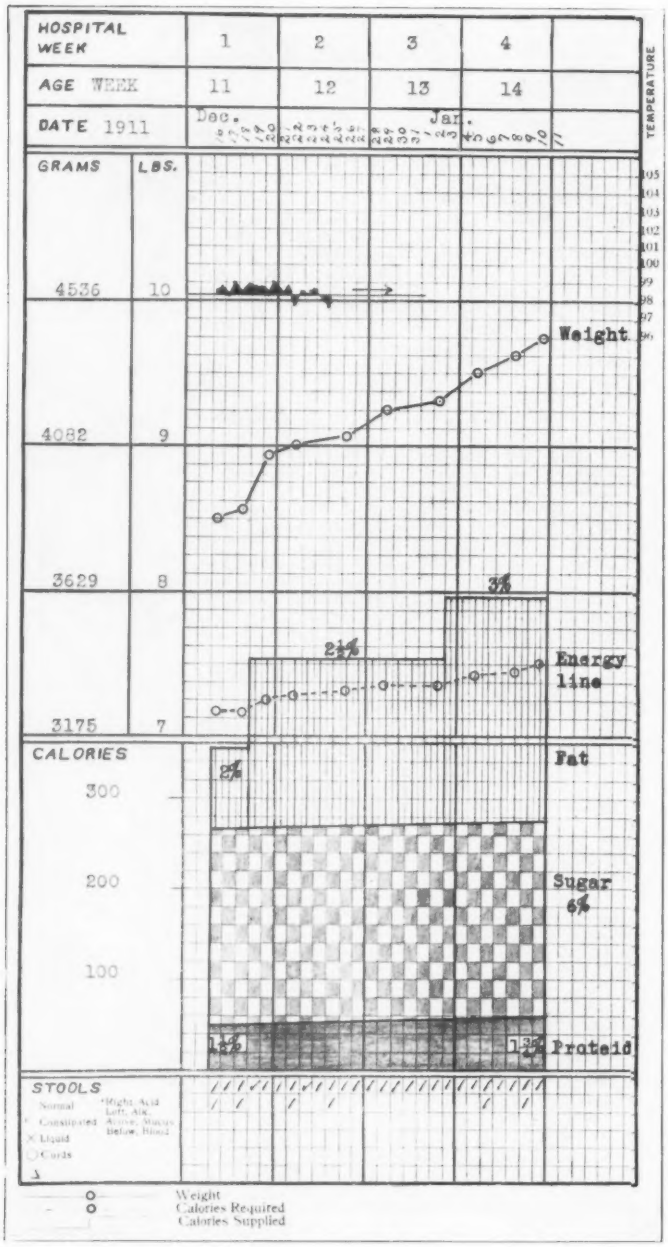

Chart 2.—Illustrating the minimum proteid requirement and the number of calories that must be furnished by sugar and fat to protect the proteid in its work of tissue building.

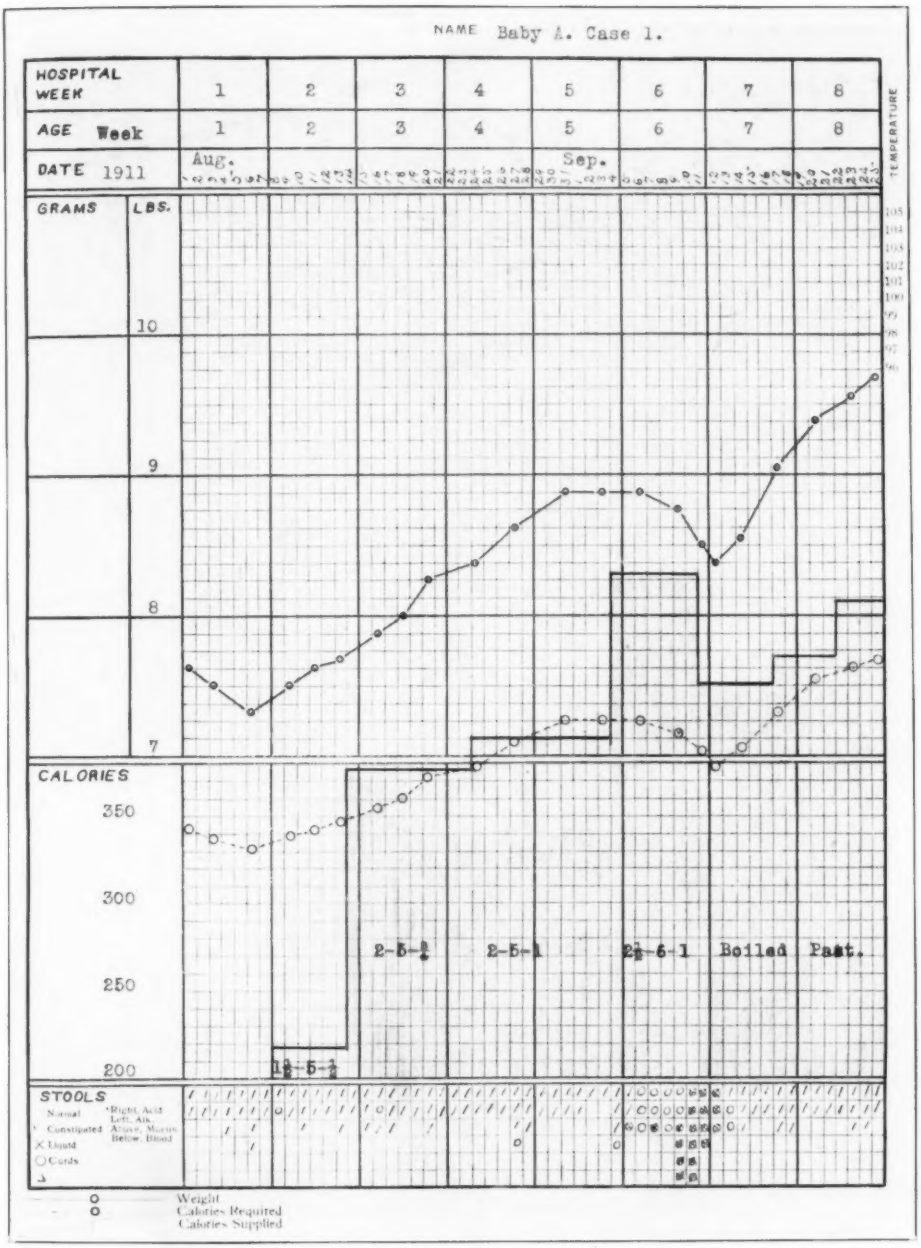

Chart 3.—1½-5-½ etc. = 1½ per cent. fat, 5 per cent. sugar, ½ per cent. proteid.

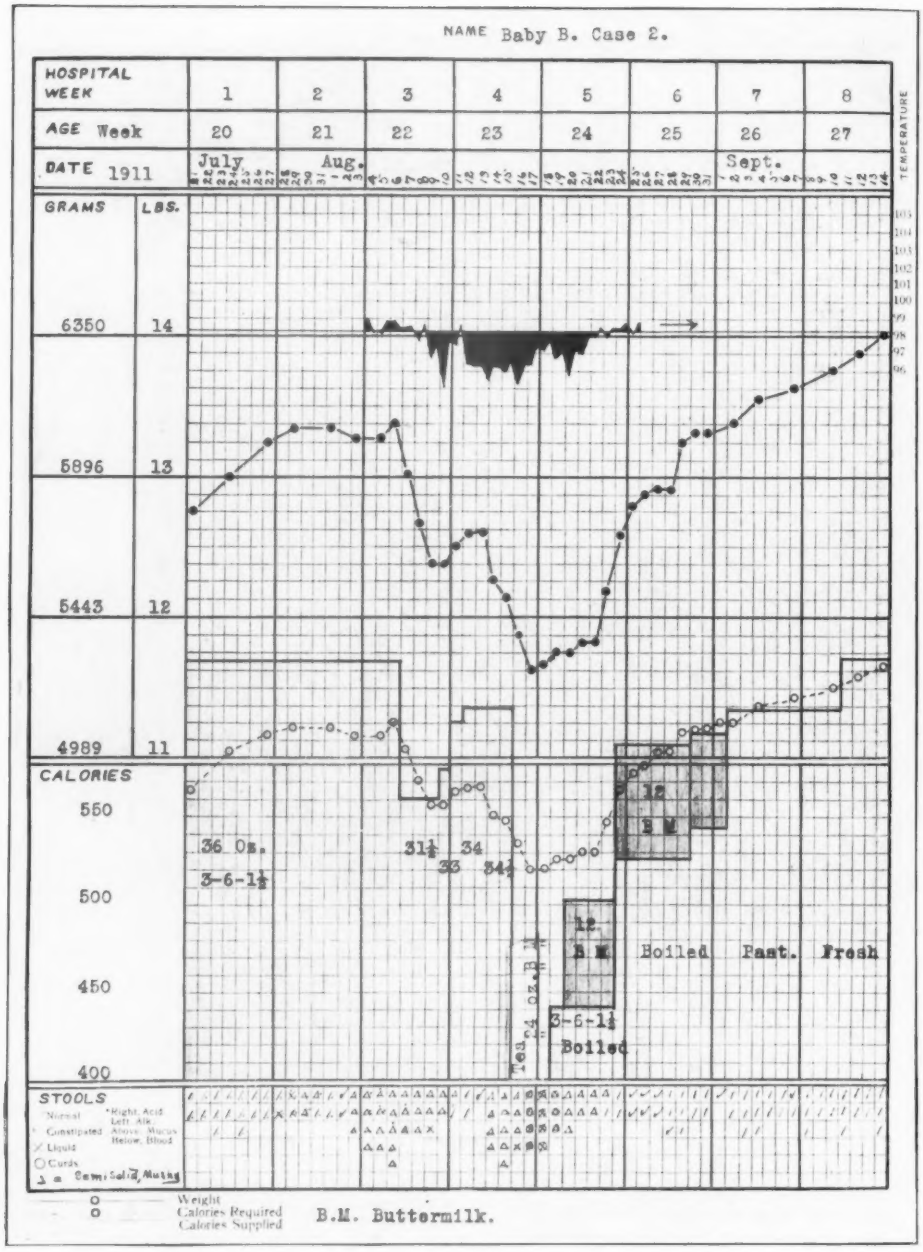
NAME Baby B. Case 2.
HOSPITAL WEEK
AGE Week
DATE 1911
July
Aug.
Sept.
GRAMS
LBS.
6350
14
5896
13
5443
12
4989
11
CALORIES
550
500
450
400
36 Oz.
3-6-1½
31½
33
34
34½
12
B. M.
Boiled
Past.
Fresh
STOOLS
Normal
Constipated
Liquids
Curds
Weight
Calories Required
Calories Supplied
B.M. Buttermilk.
TEMPERATURE

Chart 4.

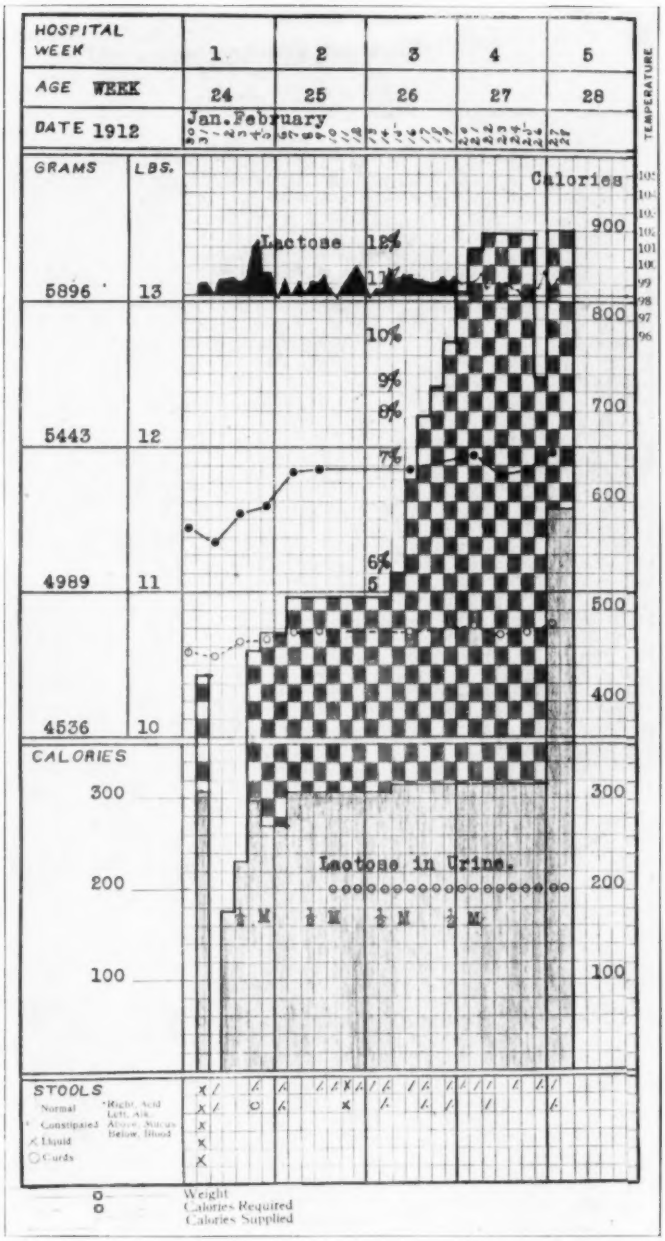

Chart 5.—Illustrating high sugar tolerance; ½ M = half milk. The checkered portion shows amount of lactose added to the ½ M.

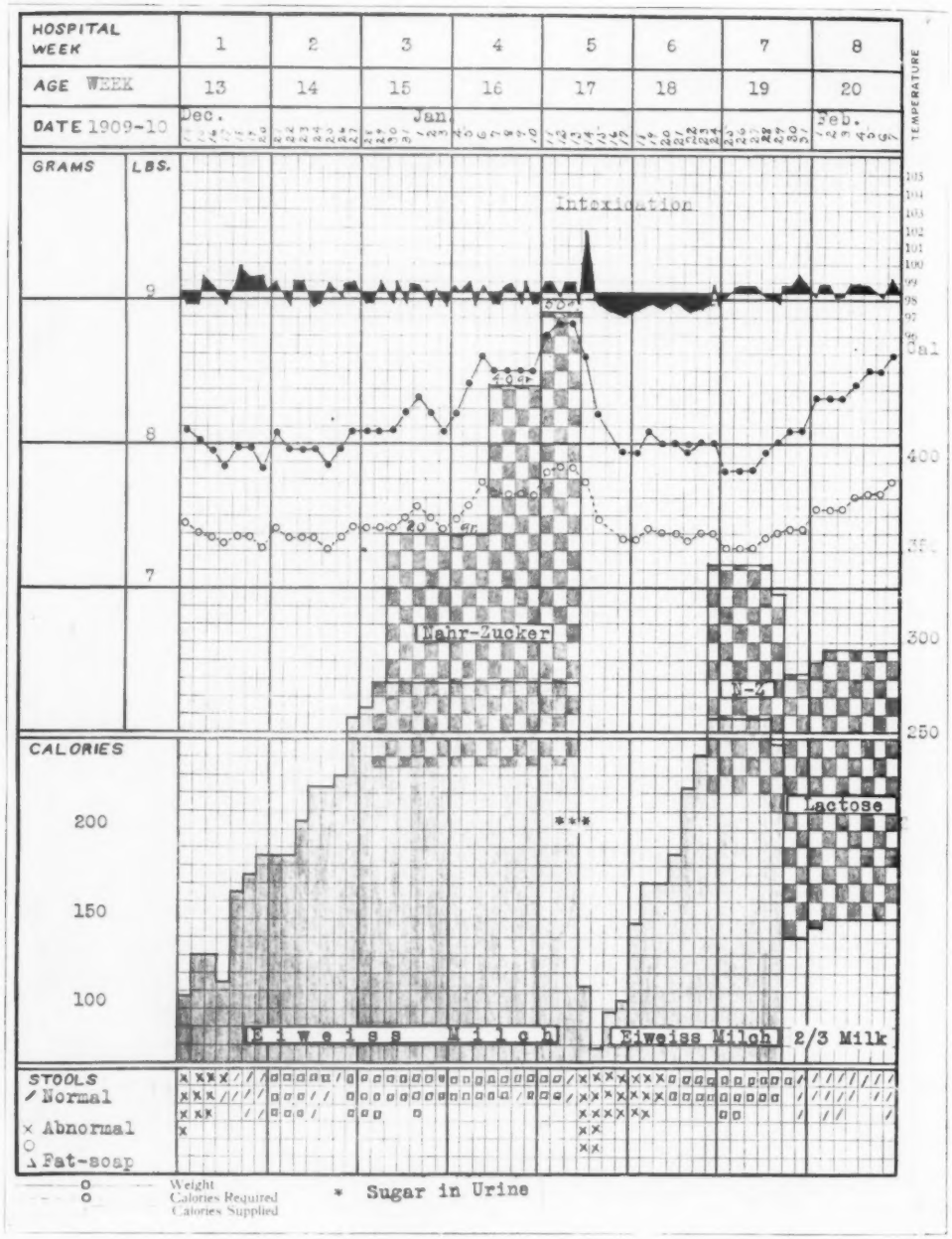

Chart 6.—Illustrating low sugar tolerance and resulting slight intoxication. The checkered portion below the *Eiweissmilch* line gives the approximate amount of sugar supplied in this food, above the line the amount of sugar added. The caloric value of the *Eiweissmilch* was doubtless higher than here estimated. Adopted from Finkelstein and Meyer. See text.

In the present case, one ounce of 2-6-1.5 mixture has a caloric value of 14.8; 385 calories are required to bring the food up to the energy line. This number divided by 14.8 gives approximately 26 ounces, as the total amount of food. The food for a new patient is usually started a little below the line and later is pushed, as a routine, 30 or 40 calories above the line, to the approximate point of optimum tolerance.

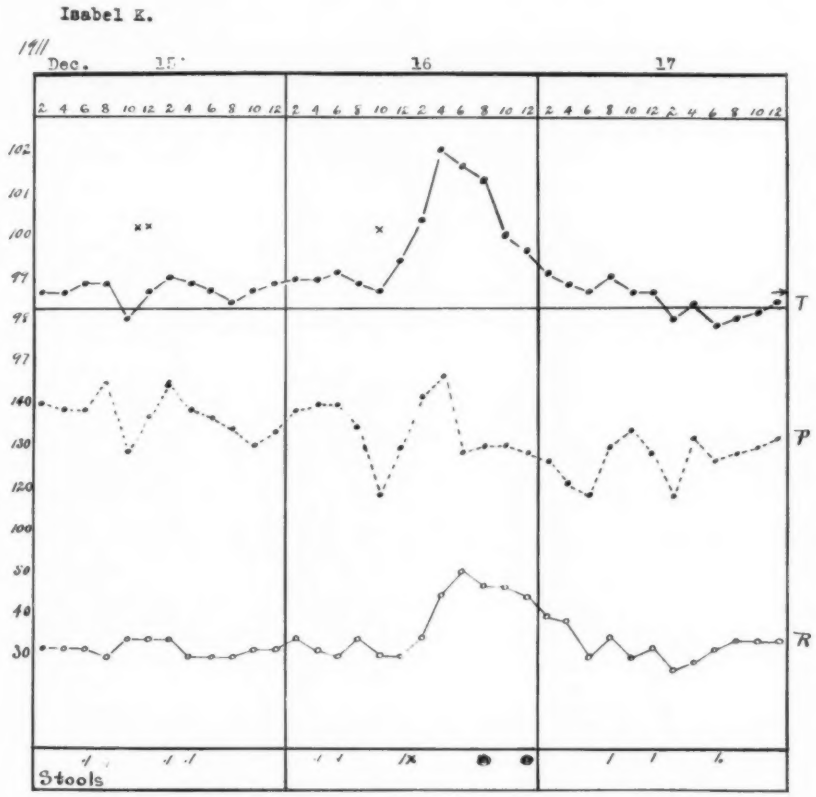

Chart 7.—Temperature, pulse and respiration curves in the case of Isabel K., a girl-baby, 10 weeks old, with normal digestion and normal stools. December 15 points marked xx 50 grams of 1 per cent. NaCl solution were given by gavage. December 16 at point x 100 grams of a 4 per cent. NaCl solution were given by gavage. There was no pyrogenic reaction following 1 gram of NaCl, but distinct reaction following 4 grams. There was also a marked respiratory increase and a pulse reaction. The stools increased in number and character after the ingestion of the salt solution.

The student is now given a number of exercises to work out in order to familiarize himself with the keeping of a chart. He is furnished with blank charts, pencils, etc., and an instructor to explain all the steps taken. He first plots the weight-curve. From this he constructs his energy line. By the time he has figured this line for one chart it becomes an easy task

for him to calculate caloric requirements. Next comes the plotting of the food blocks and the stools. The class is kept together on the first chart to avoid confusion. That is, all the members of the section start each division of the chart at the same time. The chart finished, the student discusses in writing the possible causes of the weight-drop and makes a diagnosis. The completion of the chart takes almost invariably one and a half hours.

Chart 3 results from the first exercise and represents a case of simple dyspepsia from overfeeding.

Chart 4 results from the second exercise and represents a case of marasmus or the so-called decomposition. It has taken this infant eight weeks to gain 1 pound. This gain is accomplished by feeding close to the energy line. It illustrates low food tolerance. The primary drop in the third week is overcome by lowering the food below the energy line. A substantial gain is made with partial improvement in the stool, but when

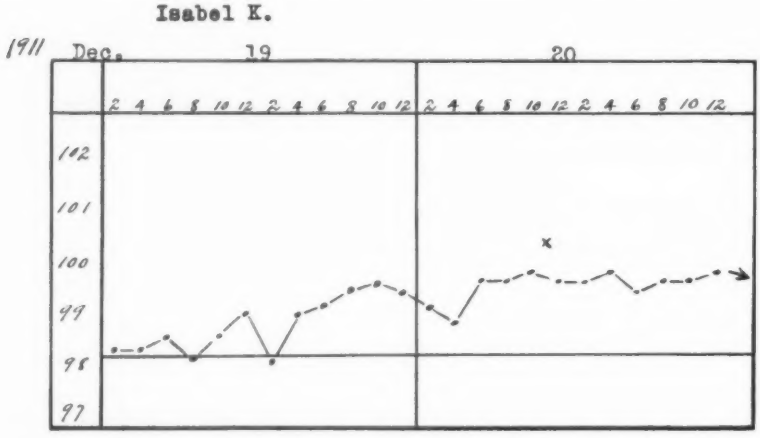

Chart 8.—Temperature curve in case of Isabel K. At point marked x 100 c.c. of 4 per cent. sodium bicarbonate solution were given by gavage. No pyrogenic reaction followed. The elevation of temperature was due to developing chicken-pox.

the food goes 50 calories above the line a relapse takes place. The further treatment of the case is self-explanatory. These two cases are almost entirely diagrammatic and are not given out as actual cases. Further exercises are given out to be done by the student at his home.

We next take up the study of sugar tolerance. This is illustrated by Chart 5, which represents an actual study of a case by the section.

In this chart a very marked sugar (lactose) tolerance is shown. In this normal infant on the seventeenth day, after a week of stationary weight, gradually increasing percentages of sugar were added, as indicated on the chart. When 5, 6, 7, 8, 9, 10, 11 and 12 per cent. are indicated,

approximately 48, 53, 78, 90, 117, 126, 141 and 146 grams of lactose are supplied. While there was no increase in the weight, as might have been expected for a short time, there was no marked fall, no rise in temperature, no increase in the frequency of the stools and no sugar appeared in the urine. The rise in temperature during the first week was due to circumcision.

In Chart 6 just the opposite condition is recorded. On the addition of only 50 grams of sugar, or when the sugar in the food is approximately 7 per cent., distinct symptoms of intoxication are produced. Coincident with sharp rise in temperature there are a number of abnormal stools, a decided drop in weight and the occurrence of sugar in the urine. With a reduction in the food, particularly in the sugar content, the weight ceases to drop and does not rise again until the food block nears the energy line. In this case a substantial gain is recorded with the food 80 calories below the energy line.

I have constructed this chart (5) from one of Finkelstein and Meyer's cases.[1] The stools are supplied but they conform to the characteristics exhibited in mild cases of sugar intoxication and in infants fed on *Eiweissmilch*. In this case preceding the records here presented, during the twelfth week, while the infant was being fed buttermilk plus 5 per cent. lactose (making in all about 7.5 per cent. lactose) symptoms of dyspepsia developed with slight elevation of temperature. The improvement following the treatment with *Eiweissmilch* is indicated. There is first a period of seventeen days of practically stationary weight when with the addition of 20 grams Nährzucker, bringing the food line up to the energy line, the weight begins to increase until the point of intolerance is reached by the addition of 50 grams of sugar which brings the food 85 calories above the energy line. The characteristics of sugar intoxication and its treatment according to Finkelstein are indicated on the daily records which follow. With the exception of the weight-curve the chart bears little resemblance to the original from which the data was taken and converted into English terms.

This case brings up the subject of the effect of salts in infant feeding. During the period of buttermilk feeding in the case just mentioned there developed along with the dyspepsia a slight fever. It is not difficult to figure out the amount of salts the infant got during this time and one might reason that the dyspepsia and the intoxication following it some weeks later may have been due to injury of the intestinal epithelium by these salts. I therefore present some illustrations of the effect of feeding varying amounts of common salt to healthy babies. The following case will serve as an example. (Charts 7 and 8.)

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1. Finkelstein and Meyer: Case 24, Curve 10, Jahrb. f. Kinderh., lxxi, series 3, xxi.

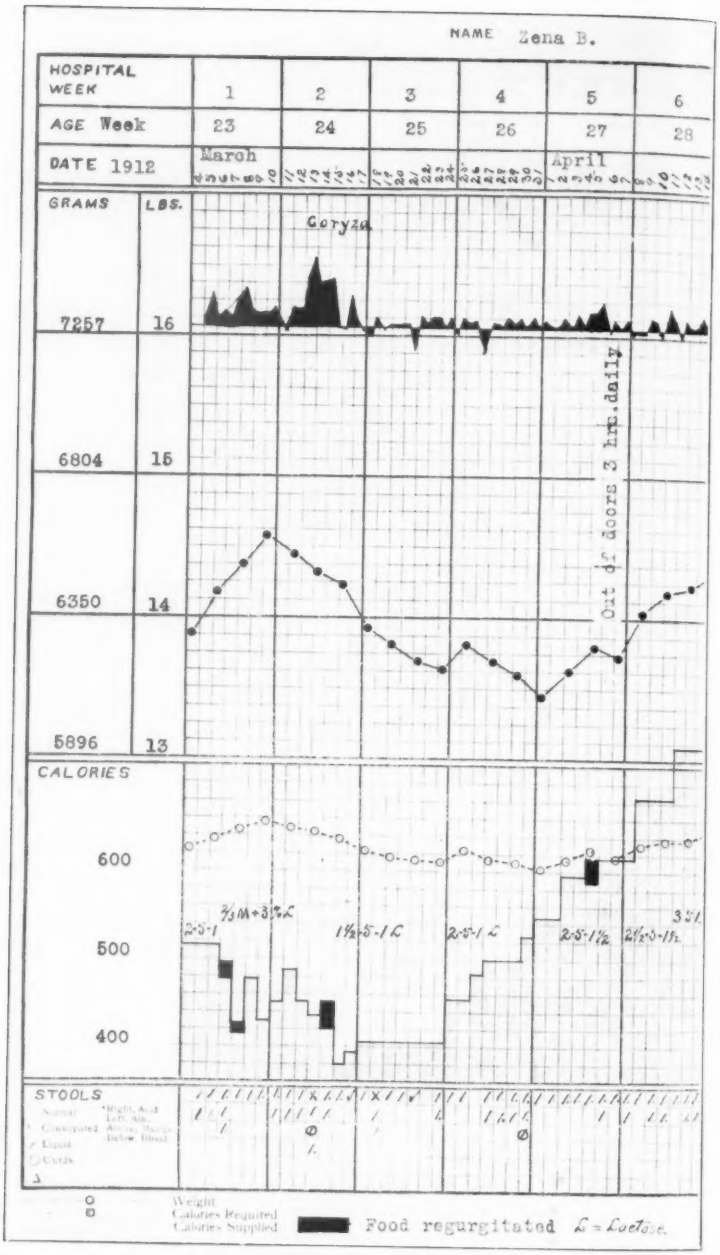
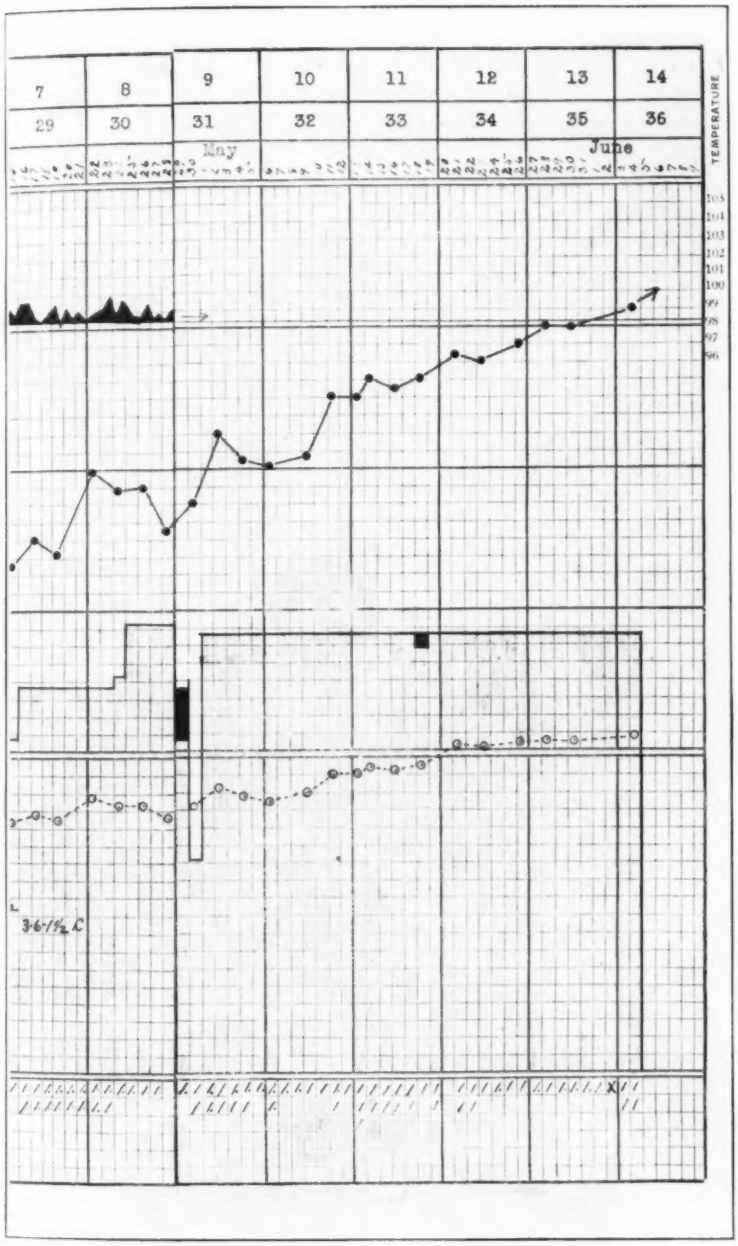


Chart 9.—A good illustration of the value of the energy lines (calories dressings for club feet. In later weighings



required). The gain during the first week is largely due to adjustment of plaster weight of dressings accounted for.

Isabel K., girl baby 10 weeks old, with normal digestion and normal stools. On December 15 after a stationary temperature for eight hours and normal temperature prior to that time she is given by means of gavage in two doses an hour apart 100 grams of a 1 per cent. sodium chlorid solution, which represents 1 gram of salt. No pyrogenic reaction follows. Twenty-four hours later 100 grams of a 4 per cent. solution of sodium chlorid is given in one dose, by gavage. This represents 4 grams of salt. A distinct and marked pyrogenic reaction develops, reaching its height in six hours, declining to normal in eighteen to twenty hours. During the pyrogenic phase there is also a marked respiratory increase and pulse reaction as well as an increase in the number, and a change in the character of the stools. This phenomenon occurs with such great regularity when the proper amount of salt is given that it is very easy of demonstration before the class.

By Chart 8, and others which are not necessary to print, the specificity of the salts is illustrated. In this same case several days later the effect of sodium combination with the non-halogen element carbon is tried. Four grams of sodium bicarbonate produces no pyrogenic reaction and at this point it is shown that in milk the halogen combinations of sodium alone produce the pyrogenic reaction. It is therefore the sodium chlorid in the milk which is responsible for this reaction and is a constituent of the infant's food which should be considered in cases of obscure fever, diarrhea, etc., as well as the sugar and other constituents of the food. The subject of water retention by the sodium salts is also suggested at this time.

The student is now ready to go into the wards and follow his cases through. Since developing this chart method an interest in even the usually uninteresting cases has been awakened. The student feels that he is really doing something and although his visits night and morning to the ward are kept track of, the tendency to bolt has practically disappeared. I might record many charts like Chart 9, which have been kept by the students. This case shows the importance of carefully watching hospital cases. It is really difficult to do this without a graphic chart of some kind.

Zena B. (Chart 9), club foot, was referred to the pediatric department for nourishment. She was in one of the surgical wards in another building and away from the direct observation of the nurse in charge of the feeding cases. The intern had prescribed a 2-5-1 formula. The child made a good gain in its first week in hospital. On the fourth day the intern tried a simple milk dilution, bringing the sugar up to approximately 6 per cent. by an addition of 3 per cent. lactose. About this time the child developed a coryza with slightly abnormal stools, fever, and loss of weight. The fever subsided after four days, the stools became normal after one day but the weight continued to fall. On the twenty-first day the child was brought to the Palmer ward (Ped. Dept.) and a chart was started (Chart 9). It will be observed that the infant was being fed far below the energy line. The food was gradually increased to the energy line and pushed above it with the results seen in the chart. The black areas represent the number of calories lost through regurgitation. The marked regurgitation on April 29

2. Dividing the dose as in the control makes no difference in the result.

following declining weight after marked increase in the food and refusing of the total quantity made us fear the development of a dyspepsia from over-feeding; consequently on the following day the child was fed below the energy line. No bad symptoms developing, the food was again pushed to just a little below the former point, with only one day of slight regurgitation in six weeks. The temperatures are all rectal. We find that a large per cent of our babies run a temperature like the one plotted, from the third hospital week on, without any discoverable cause. It may be well to state that the salt content in our percentage formulæ is never excessive. This chart is an exact copy of the one made by the student in charge of the case.

It is not the purpose of this paper to demonstrate any classification of the digestive disturbances of infancy. It is apparent how a chart can be used to illustrate the various causes of stationary, declining and increasing weight with their attendant symptoms and signs.

The lessons we learn from practical use of a graphic chart are that changes in weight are usually explained at a glance; that a child cannot make substantial gain on feeding below its caloric needs; that he may often make a loss by feeding far above the line and that when strict attention is given to this point, with proper adjustment of percentages and attention to fundamental principles, most cases improve. There are instances in which the very best of care and thought cannot suffice to bring about improvement.

HELMINTHIASIS IN CHILDREN*

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CHICAGO

The subject of helminthiasis in children has been revived in the literature in the last few years. The statistics as given in the text-books have been drawn from the clinical work in hospitals and private practice and are naturally inaccurate, as many of the cases show no symptoms and the clinical examinations have not been controlled by careful laboratory examination. In the last few years, however, there have been two investigations reported, based on thoroughly scientific work. The earlier work, that of Stiles and Garrison, reported in 1906, gives a thorough digest of the voluminous literature and was practically the only report on the subject in the United States until Schloss reported his series of 310 cases from the clinics of three hospitals in New York. The latter report was the direct stimulus for the present investigation. The percentage of infections (28.57 per cent.) reported in this paper being so much higher than clinical reports would indicate, gave rise to the question whether the percentage rate was really lower among the cases in the Chicago clinics, or whether the routine examinations in the laboratory had been inadequate. With these questions in mind, the present investigation was started.

The work was carried on in the laboratory of the Michael Reese Hospital and extended over a period of eight months. The cases were taken from patients in the Children's Ward in this hospital. They were taken consecutively as they entered without regard to whether they showed any symptoms referable to infection with parasites.

The purpose of the work as outlined was primarily to determine: First, the frequency of infection with intestinal worms in children between the ages of 2 and 12 years; second, the species of parasites harbored; and third, the relative frequency of infection with the different species of parasites.

The question of the constancy of eosinophilia in infections with intestinal worms, the number of cases that show the usual symptoms of helminthiasis and the nature of those symptoms, were considered secondarily only, as the cases were all patients admitted to the wards for some affection other than helminthiasis.

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*From the department of Pediatrics and the Laboratories of the Michael Reese Hospital, Chicago.

The method of examination used for diagnosis was a careful macroscopic and microscopic examination of the feces for the parasites, parts or segments of the parasites, their ova or larvæ, and the results reported are based on such findings. As often as it was possible, the stools were obtained after a purge with calomel and in every case that was doubtful or positive the duplicate examinations were after a thorough calomel purge. An average of two and a half stools was obtained from every case, though in thirty-four of the cases it was impossible to obtain more than one stool, owing to the patient disappearang from our observation, or for similar reasons. The technic of the microscopic examination consisted of an emulsion of a small portion, approximately 10 to 15 grams, of the thoroughly mixed feces in 30 c.c. of distilled water, varying the amount as necessary to make a translucent mixture, and from

TABLE SHOWING COMMON SYMPTOMS IN HELMINTHIASIS

No.	Age	Sex	Race	Nationality	Intercurrent Disease	Parasite	Gastrointestinal	Nervous	Loss in Weight	Skin
1	6	F.	R. J.	U. S.	Chorea	T. t.	Appetite poor	Very nervous	.....	.....
2	10	M.	R. J.	U. S.	Mitral and Aortic Insufficiency	T. t.	Appetite poor abd. distress	Restless	.....	.....
3	8	M.	R. J.	U. S.	Endocarditis	T. t.	.....	.....	.....	.....
4	4	M.	R. J.	U.S.	Leg burn	Asc.l	.....	.....	.....	.....
5	2½	F.	R. J.	U. S.	Chronic Osteo	Asc.l	.....	.....	.....	.....
6	6	M.	R. J.	U. S.	Helminthiasis	Tae.s	Appetite poor	Slightly	Slight	Purpura hemorrhagica
7	4	M.	R. J.	U. S.	Burns	Tri.i	.....	Restless	.....	.....

this emulsion not less than five preparations were made from each stool by placing a drop on a glass slide and covering with a cover slip. These were then studied very carefully with both the two-thirds and one-sixth objectives. In all, stools from 102 children were examined. The age limit was set at 12 years, as the intention was to confine the investigation entirely to children.

In regard to the nationality, a word must be said, as it may have a direct bearing on the significance and interpretation of the results. The patients were almost entirely of Russian Jewish parentage, although nearly without exception of American birth. The fact that all the statistics of the foreign reports show a very much higher percentage of infections than any of the reports for the United States would make this point vital in interpreting this report as an index to conditions in the United States.

A very large majority of the cases were taken from the charity wards of the hospital. They represent, therefore, the children from the homes of the poorer classes, where the housing conditions and mode of living are far from good. The questions of occupation, place of residence, rural or city, and previous residence, have all been answered.

Stools were examined, then, from 102 of these patients under 12 years of age and the following results were obtained: Of the 102 children, seven, or 6.86 per cent., harbored parasites, and one case was infected with two species of parasites, making a total of eight infections, or 7.84 per cent. Of these, the *Trichiuris trichiura* was present four times, or in 3.92 per cent. of the cases; the *Ascaris lumbricoides* in two, or in 1.96 per cent. of the cases, and one case each of infection with *Tænia saginata* and *Trichimonas intestinalis.*

Since these seven positive cases were in the hospital with a diagnosis other than helminthiasis, it is difficult to attribute any one symptom or group of symptoms to the one or the other affection. Further, it follows that the symptoms of the intercurrent diseases being most prominent, may overshadow and obscure the manifestations of infection with intestinal parasites and make the interpretation of these evidences difficult and at best presumptive. In the preceding table have been tabulated the symptoms most commonly attributed to helminthiasis.

The blood-picture in the cases shown in the table was as indicated in the following table:

Number	1	2	3	4	5	6	7
Hemoglobin	78	90	75	not	85	75	85
Eosinophils	0	3	3	made	5	8	0

Taking these up in order, we have first, gastro-intestinal symptoms. Two cases (1 and 2) of infection with *Trichiuris trichiura* and one case (6) with *Tænia saginata* infection, showed slight gastro-intestinal symptoms. In the two latter cases, no other etiology being determinable, it was fair to suppose that the symptoms were referable to the helminthiasis. In only the one case (6) was this proven by the disappearance of the symptoms following the treatment. Nervous symptoms were seen in three cases (1, 2 and 7). These three patients showed restlessness and insomnia, but in none of these could these symptoms be determined as due to the parasites, as the intercurrent disease was more probably the cause. No history or record of appreciable loss of weight was given in any one case except that of the boy harboring a fat tapeworm, and here there was only a moderate loss; in no sense an emaciation. There was but one case which showed any skin manifestations (6). This boy showed

a rather colorless, transparent skin and shortly after the presence of the worm was discovered, he developed purpura hemorrhagica on the elbows, shoulders and back. This lasted only a few days and all evidence of it disappeared after treatment was instituted.

In none of the cases was there any anemia worthy of note. In all, the red count was practically normal and the hemoglobin tests (Dare) showed no case below 75 per cent. and only three below 85 per cent.

Of these seven cases showing infection with parasites, eosinophils were increased in only three cases and in only one of these was there a true eosinophilia. One case infected with the *Trichiurus trichiura* showed a 3 per cent. eosinophilia in a white count of 9,200; one case of *Ascaris* infection, a 2 per cent. eosinophile count in a total count of 20,000 whites, and the third case, the infection with the *Tænia saginata,* showed 8 per cent. eosinophils in a 10,000 total white count. It is easily seen then that in the first two, the *Trichiurus trichiura* infection with 276 eosinophils and in the *Ascaris* infection with 400 eosinophils, there is no increase in the normal number of cells. In the last case, however, the *Tænia saginata* infection, with 800 of these cells, there is the only absolute eosinophilia.

It will be seen then, that there was no constant set of symptoms present that could justly be referred to the helminthiasis. Further, the few symptoms that were evident bore no relation to any particular species of parasites. Case 6, the infection with the fat tape-worm, is the only case that could definitely be stated to have shown anything like a typical text-book picture. Here the poor appetite, some restlessness and irritability, slight loss of weight, mild anemia and the purpura hemorrhagica, with the actual eosinophilia, which disappeared with complete recovery following treatment with santonin and calomel, place this single case beyond question.

SUMMARY

1. Careful examination of the stools from 102 children from 2 to 12 years of age showed that 6.86 per cent. were infected with intestinal parasites. In one case there was a double infection giving a total of eight infections. This low percentage is extremely interesting, especially when compared with those reported by the only two others who have carried on similar investigations. Schloss, of New York, from 280 examinations reports 28.57 per cent., and Stiles and Garrison from 123 examinations report 21.14 per cent.

2. Four (3.92 per cent.) of the cases were *Trichiuris trichiura* infection; two (1.96 per cent.) were *Ascaris lumbricoides* infections; one (.98 per cent.) was a *Tænia saginata,* and one (.98 per cent.) was a *Trichimonas intestinalis.* Comparing these with the relative frequency

shown in other reports, we find the results very similar for these three species of parasites. In all reports, the *Trichiuris trichiura* is three to four times as prevalent as any other parasite. The *Ascaris* is usually mentioned as one of the most common intestinal worms, but the more recent reports seem to disprove this view; the report of Stiles and Garrison showing only .81 per cent. of cases harboring this worm.

3. Only a small percentage of cases infected with intestinal parasites display any obvious symptoms.

4. Eosinophilia was not constant as a symptom of helminthiasis, but when present, it accompanied the other clinical manifestations. Further, its presence bore no relation to the species of parasite harbored.

We realize that the small number of cases and the limits of this series of examinations must be remembered in considering the statistical value of our results. However, we feel that the results justify the conclusion that infection with intestinal parasites is much less frequent among the children of the poorer classes of Chicago than is generally conceded to be the case.

In conclusion, I wish to acknowledge my indebtedness to Dr. Julius H. Hess and to Dr. Solomon Strouse for assistance in the preparation of this report. Also to the members of the pediatric and pathologic staffs of the Michael Reese Hospital for many courtesies shown and to the Department of Pediatrics of Northwestern University Medical School through whom the work was made possible.

Michael Reese Hospital

SERUM TREATMENT OF PNEUMONIA*

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During the past few years many new methods for the treatment of that very fatal disease of infancy, pneumonia, have been instituted, but few of these have been markedly successful. Many of us believe that the use of out-of-door air has done more to limit the mortality of pneumonia than has been demonstrated for any of the treatments based on laboratory investigation.

Of the three treatments that come under this class one may mention the use of leukocyte extracts advocated by Dr. Hiss; the use of vaccines either commercial or autogenous, and, finally, the use of the serum.

The leukocyte extract of Hiss has produced some striking results, but has not as yet had sufficient use, I believe, to determine accurately its value. But in a report issued by Hiss and Zinsser[1] in 1908, they describe eight cases with recovery and with a reduction of temperature usually within two to four days after the injections were begun. These injections were repeated daily.

Vaccines, particularly autogenous vaccines, have been considerably used and some of the reports are quite favorable, but Stoner,[2] who has collected 155 cases of pneumonia, in which the patients were treated with vaccines, reports a mortality of 12.9 per cent. Howland and Hoobler report fifty cases, mostly in young children with bronchopneumonia, and some older ones with lobar pneumonia, treated with stock vaccines, but with no favorable results. A few cases also were treated with autogenous vaccines with similar results.

In going over the literature it has seemed to me that the results obtained from the so-called Romers' serum, a pneumococcus serum, have been in general very favorable. Thus Kriske[3] reports ten cases in children from 9 months to 10 years of age in which he noted a distinct improvement after the administration of the serum and all the children recovered. May[4] reports good results in twenty cases with increased leukocytosis.

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* Read at the meeting of the American Pediatric Society, Hot Springs, Va., May, 1912.

1. Hiss and Zinsser: Jour. Med. Research, 1908, xix, No. 3, p. 321.
2. Stoner: A Résumé of Vaccine Therapy. Am. Jour. Med. Sc., 1911, cxli, 186.
3. Kriske: Zur Serumtherapie de kruposen Pneumonie. Med. Klin., 1908, iv, 1881.
4. May: Ueber die Wirkung des Romerschen Pneumokokken-serums bei der kruposen Pneumonia mit besonderer Berücksichtigung der Leukocyten. München. med. Wchnschr., 1908, lv, 2140.

Monti[5] used it in twelve cases with decided benefit, while Knauth,[6] Linderstern,[7] Tunher[8] and Crux[9] used it with favorable results. Brunning[10] treated six patients with falling temperature, slowing of the pulse and general improvement after the administration of the serum. All these observers used a dosage of about 10 c.c. for children and 20 c.c. for adults.

Morse, in 1903, reported to this society eight cases in which the patients were treated with 5 c.c. of pneumococcus serum every four hours, or about 30 c.c. daily, and concluded that the treatment "had no effect on the duration of the disease, the course of the temperature, the rate of the pulse and respiration or the progress of the local condition. Complications occurred at least as frequently as is usual. Death occurred in an unusually large percentage. The serum, while it apparently did no good, certainly did no harm."

On account of the usually favorable results of treatment with antipneumococcus serum it seemed worth while to try it in a series of cases, using alternate cases as controls. This work was undertaken at an institution where the children have poorer reaction to disease than is usual in private practice, and where under any form of treatment many children go on after pneumonia with a condition of unresolved pneumonia which persists for week or months.

The cases admitted to this series were in patients showing a fairly high temperature with good signs in the chest. One of the injected patients had a severe pneumonia complicating measles, another measles-pneumonia being used as a control. This patient showed no good effects from the serum and finally died of general septic conditions and endocarditis. Three patients injected are not included in this paper; two that were moribund when injected and were injected simply to see whether the serum might help them. One of these was rigid and comatose and made no cry when the large needle was thrust into the abdominal wall and died within four hours after the injection. In the other similarly hopeless case the patient died within twenty-four hours after injection. I also injected an adult who recovered.

The first seven of the patients were injected with a simple pneumococcus serum, a large dose, 100 c.c., being injected and in some cases repeated. The injection was done by means of a buret (Fig. 1) made for salvarsan injection and a rubber tube with a glass section near the needle

5. Monti: Arch. f. Kinderh., 1908, xl, 45.
6. Knauth: Deutsch. med. Wchnschr., 1905, No. 12.
7. Linderstern: München. med. Wchnschr., 1905, No. 39.
8. Tunher: Wein. med. Wchnschr., 1906, No. 11.
9. Crux: Zwolf Falle von Lungenentzundung im Kindesalter mit Romer's Pneumokokkenserum behandelt. Deutsch. med. Wchnschr., 1908, xxxiv, 16.
10. Brunning: Kinderpneumonie und Pneumokokkenheil-serum. Deutsch. med. Wchnschr., 1911, xxxv, 42.

and a very large needle, this being necessary as the blood serum will not flow freely through a small needle. The injections were all made into the anterior abdominal wall and it was found that by keeping the end of the needle in the fascia below the skin and gradually advancing this rather long needle 100 c.c. could be readily delivered with one penetration of the skin. Pressure was made in addition to that of gravity by the use of a rubber bulb attached to the buret.

The first seven patients received 100 c.c. of pneumococcus serum, while the last eight cases received 50 c.c. each of pneumococcus and streptococcus serum. This serum was that of the New York Board of

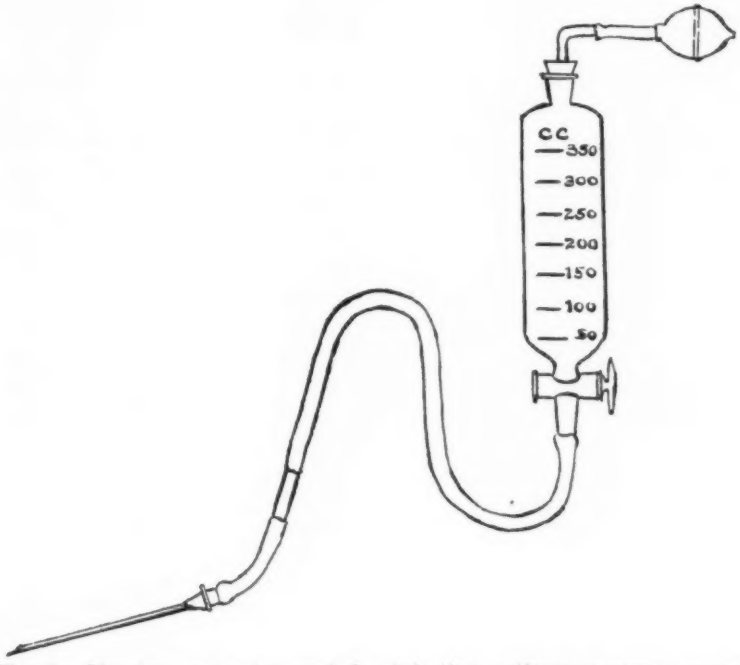

Fig. 1.—Showing apparatus used for injecting antipneumococcus serum.

Health and I am indebted to Drs. Park and Nicoll of this department not only for the serum, but also for advice as to its use.

In none of the cases was there any evidence of irritation at the point of injection. The serum was rapidly absorbed and there was no inflammatory disturbance. In all of the cases, on the other hand, the injections were followed by urticaria, sometimes appearing on the following day, often ten days later, but without fever or general disturbance. In one case in addition to the urticaria an ankle joint was swollen, hot and painful, but this subsided in twenty-four hours and was accompanied by little rise in temperature.

The children injected varied in age from 2 months to 3¼ years, the average age being 20 months, while the controls ranged in age from 3½ months to 3½ years, with an average age of 11 months.

As to the effect of the serum, there was in many cases an immediate change in the appearance of the child. Children that looked septic, were apathetic, with anorexia and a pale blotchy complexion, in several cases after the injection, had a good color, were brighter, took the feedings better and seemed much improved, although the condition in the lung was usually unchanged or perhaps spreading.

Before going into the general effect of this treatment I would like to call attention to charts of several cases with marked results, to indicate that in some cases the serum seemed to be of real benefit.

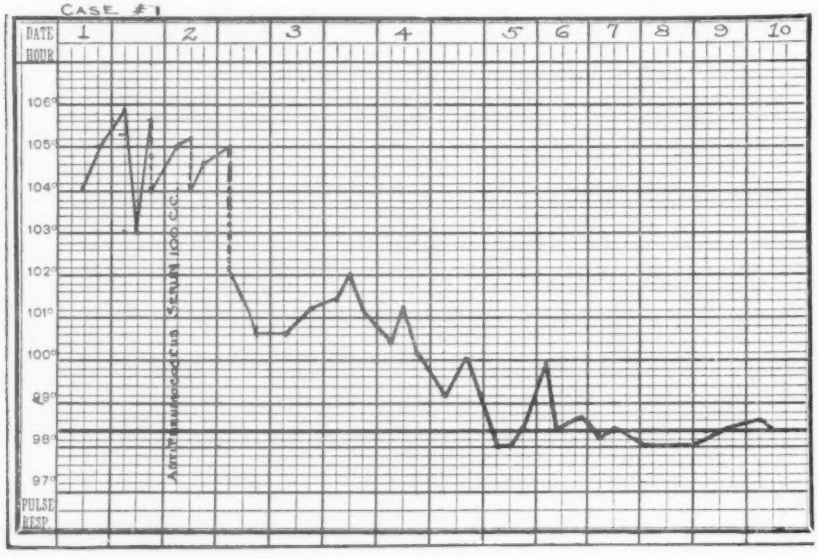

Fig. 2.—Temperature curve in Case 1, showing effect of injection of antipneumococcus serum on second day.

Case 1 was a child that had appeared very sick, the temperature ranging from 103 to 105.8 F., and being 105.2 F. at the time of the injection (Fig. 2). The physical examination showed crepitant râles, increased voice and high-pitched breathing over the upper part of the right lower lobe and over the right middle and upper lobes. After the injection the temperature immediately dropped to 102 F. and then gradually to normal, reaching that point three days after the injection and remaining normal after the fourth day. This injection was made on the second day of the disease and on the following day the signs showed an involvement of the posterior portion of the right lung, while on the third

day after the injection and the fourth day of the disease the signs in the chest cleared up. This was fortunately the first injection case and made a very favorable impression on the people at the institution.

Another striking case was Case 6, in which the patient suddenly had a temperature of 104.1 F., with cough and cyanosis. On examination of the chest in the left subscapular region there was dulness, bronchial breathing, sharp subcrepitant râles, with harsh breathing and crepitant râles lower down, while on the right side there were sibilant râles. After injection the temperature dropped immediately to 99.6 F. (Fig. 3) and never rose, and the signs in the chest gradually cleared up. This seemed like a very wonderful result, but our control patient with no serum did exactly the same thing.

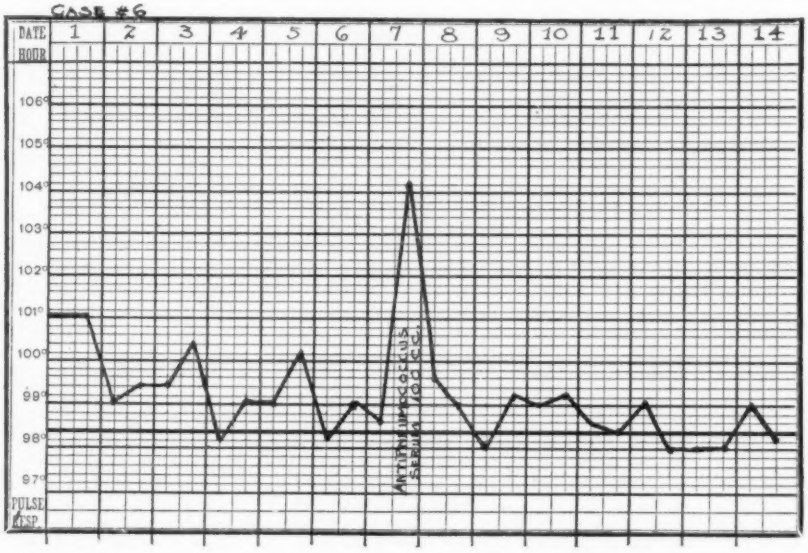

Fig. 3.—Temperature curve in Case 6. Injection of antipneumococcus serum on seventh day.

In Case 10 the child was injected on the fourth day after admission to the hospital, where it was brought on account of convulsions. At the time of injection it had bronchial breathing and crepitant râles over the right upper lobe and the temperature was 102.2 F. (Fig. 4). The temperature reached normal three days after injection. Some signs, however, persisted, but four days after the injection the chest showed only slight dulness at the right apex posteriorly and ten days later when the child was sent out of the hospital the chest was clear.

A very striking case was Case 11, in which the patient had run a steady temperature from 103 to 105 F. (Fig. 5) for four days before injection. At that time the temperature was 104 F., and over the right

lower lobe there was high-pitch respiration and fine râles, and pneumococci were obtained from a throat swab. After injection the temperature rapidly declined and reached normal in three days. In this case the leukocytosis, which was 15,000 at the time of injection, was the same on the following day, but on the second day was reduced to 8,800, while the polynuclear leukocytes changed from 41 per cent. at the time of the injection to 47 per cent.

These cases I have given simply to show that in some cases there was apparently a good reaction from the serum.

The improvement in the well-being of the children has been commented on by other observers and is not always followed by recovery.

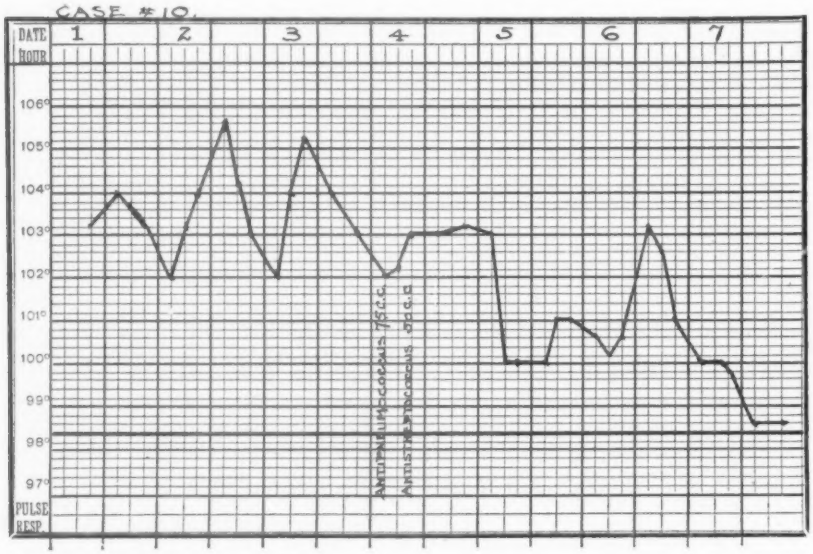

Fig. 4.—Temperature curve in Case 10. Antipneumococcus and antistreptococcus serum on the fourth day.

The effect on the temperature in some cases was marked. In seven cases there was a reduction in temperature after injection, while in eight cases there was no evident effect.

The effect on the process in the lungs was interesting for, as I have said, in some cases in which there seemed to be an improvement in the general condition of the child, the lung condition either showed no improvement or spread. Where there was a marked reduction in temperature from the injection the lung signs did not spread materially and often cleared up quickly.

The effect on the leukocytosis was studied in eleven cases (see table), most of which were injections of combined pneumococcus and strepto-

coccus serum. These showed usually a reduction in the leukocytosis, although in one case the leukocytes increased from 10,000 to 18,000 with a reduction in the polynuclear leukocytes from 70 to 44 per cent. The average of the eleven cases was a reduction in leukocytes from 25,790 to 19,333, and a reduction of polynuclear leukocytes from 67 to 63 per cent. so that the average result is not very striking. A more striking result, but on too few cases to draw any conclusions, is found by examining the three cases in which the counts were made on the third day. These show an average reduction from 29,667 on the first day to 15,300 on the second day, and of 11,933 on the third day, while the polynuclear leukocytes averaged 51 per cent. on each of these days.

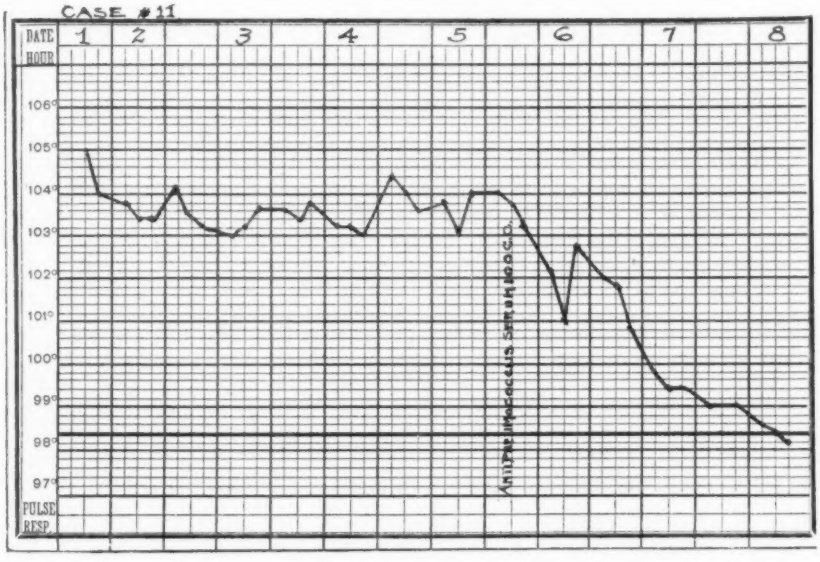

Fig. 5.—Temperature curve in Case 11. Antipneumococcus serum on the fifth day.

The effect of the injections on the duration of the disease may be studied in those patients who recovered. In these it is found that the duration after injection, as shown by fever, varied from one to nine days, the average being 5⅓ days, and the total average duration of the disease in the patients who recovered being 6 7/9 days, while of the eight control cases the average duration of six was 10½ days, and in two the temperature continued for a very long period.

The crucial test is the effect of the injections on mortality, and in this we cannot make a brilliant showing, for while of the fifteen injected patients nine recovered and six died, giving a mortality of 40 per cent.; of the fifteen controls eight recovered and seven died, giving a mortality of 47 per cent. Among the six patients injected with pneumococcus

serum alone there were four recoveries and two deaths, while the controls showed five recoveries and one death. Of the nine patients injected with the pneumococcus and streptococcus serum five recovered and four died, while of the controls of these there were three recoveries and six deaths. Repeated injections in patients who had showed no reaction from the first injection were equally unsuccessful.

RESULT OF BLOOD EXAMINATION AT TIME OF INJECTION AND TWENTY-FOUR HOURS LATER IN ELEVEN CASES

At Time of Injection		One Day Later	
Leukocytes	Percentage of Polynuclear Leukocytes	Leukocytes	Percentage of Polynuclear Leukocytes
58,000	84	18,400	64
17,800	75	11,000	69
24,400	42	21,760	79
14,000	75	14,000	74
15,000	41	15,500	47
26,000	86	17,400	48
34,000	85	36,000	95
10,500	70	18,000	44
16,000	27	12,000	40
40,000	73	21,000	70
28,000	76	27,600	71
283,700	734	212,660	701
*25,790	67	*19,333	63

*Average of the eleven cases.

In conclusion, I would say that the serum injections, while apparently affecting favorably the course of the disease in some cases, appears to have no result in others; that in most cases there appears to be a better reaction on the part of the child after injection than before. It was usually followed by some reduction in leukocytosis, and the percentage of the polynuclear leukocytes was also diminished. In these favorably influenced cases there was little spreading of the disease after injection, and in some a fairly rapid resolution.

The injected patients who lived had a much shorter average course than the controls, and the mortality of the injected cases was slightly less than that of the controls.

The pneumococcus serum presents a safe method of attempting to influence the course of pneumonia in children; the addition of anti-streptoccoccus serum seems to offer no advantage over the use of the pneumococcus serum alone.

LONG INTERVAL FEEDING OF PREMATURE INFANTS

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This paper is not presented for the purpose of proving a theory, but seeks rather to give the practical results of long interval feeding in the fifteen cases here reported.

The method of feeding was not in the beginning deliberately attempted for the purpose of testing its value, but was used in sheer desperation in the first case after failing in attempts to successfully feed the baby according to the usual procedure in the care of premature infants. The results were so striking that a thorough trial was made in the other cases and the results are here given for what they may be worth.

Any one who wishes successfully to care for the premature infant must make himself familiar with the work of Budin and his three great laws:

1. The premature infant must be kept warm.
2. It must be properly nourished.
3. It must be protected from infection.

In following out these rules of Budin an exaggerated importance was originally attached to the incubator, especially in the minds of the laity, but we know now that the *couveuse* is not necessary and that it has its dangers and disadvantages. However, the casting aside of the incubator by many of the best pediatrists and obstetricians was not on account of any desire to get away from the rule that the premature baby must be kept warm, but was only a change of method in obtaining that result. We may also modify our method of feeding without doing violence to our ideas that the nourishment of the premature infant must be wisely regulated. This plays a much more important rôle with the premature than with the full term child, because its food requirements are so much greater according to its weight and because it is so much more easily disturbed by overfeeding. It is almost universally recommended that this increased food requisite be obtained by small frequent feedings of mother's milk, and this was my practice until the experience which led me to try the long interval feeding.

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*Read in the Section on Diseases of Children of the American Medical Association, at the Sixty-Third Annual Session, held at Atlantic City, June, 1912.

CASE REPORTS

CASE 1.—Baby girl, G., born Jan. 4, 1911, weight, 2,060 gm.

This is the first case in which the long interval feeding was tried. I had followed up to this time the usual method of small frequent feedings of mother's milk but the baby did not do well. I carefully tried different short intervals as follows: Every two hours, with unsatisfactory results; then one hour and half hour intervals with varying amounts of food, but in spite of previous moderate success with most of my cases of premature babies, I was unable to keep this child from vomiting, having frequent attacks of cyanosis, rapid loss of weight and other marked signs of digestive disturbance and inanition. The infant lost over

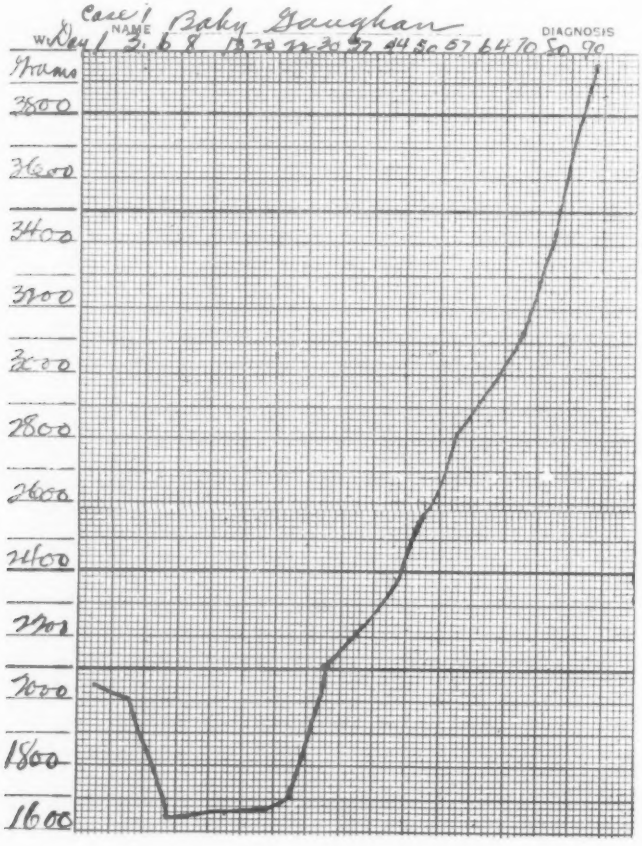

Chart 1.—Weight-Curve in Case 1

400 gm. the first five days of life. I had for some time been a convert to the long interval feeding of mature infants, so in desperation, I ordered on the sixth day four hour intervals, allowing the baby to nurse all it could which in its weakened condition was not much. It weighed at this time 1,651 gm. The change was remarkable; it stopped vomiting at once and had no more attacks of cyanosis. It slept well that night and its progress was continuous. The child gave no anxiety from the sixth to the twenty-second day, when the mother left the hospital and thereafter took entire care of the baby herself, adhering faithfully to the four hour intervals. The weight steadily increased.

Age in Days	Weight, Gm.	Age in Days	Weight, Gm.
1	2,060	37	2,112
3	2,003	44	2,227
6	1,651	50	2,370
8	1,655	57	2,586
13	1,660	64	2,800
20	1,670	70	3,130
22	1,700	80	3,414
30	1,684	90	3,962

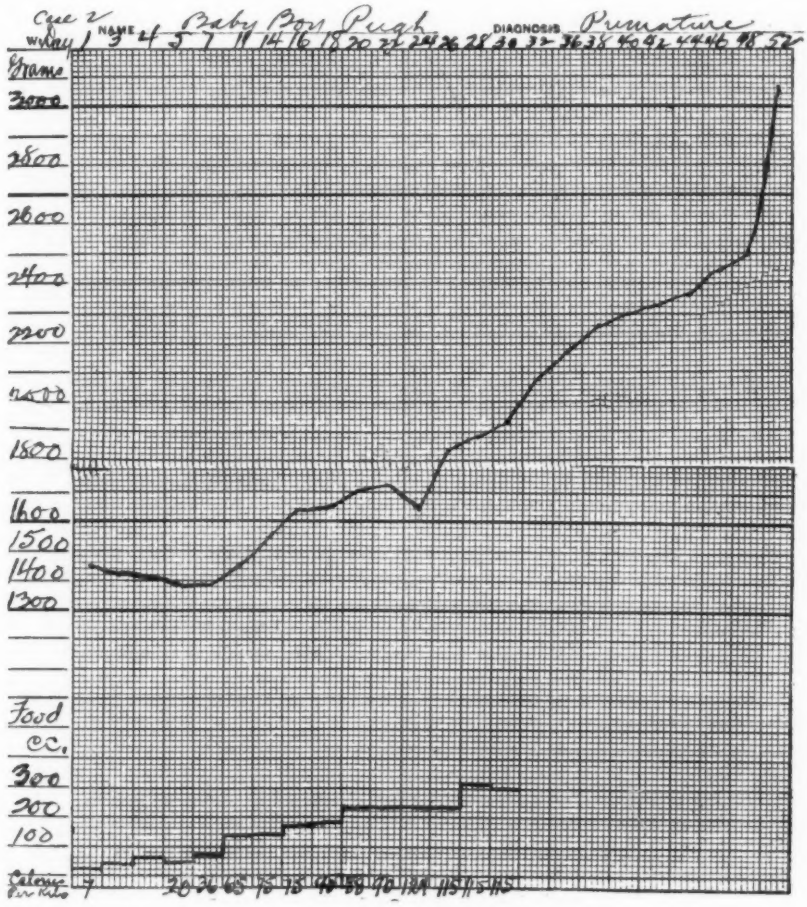

Chart 2.—Weight-Curve in Case 2

CASE 2.—Baby boy P., born June 3, 1911; birth-weight 1,450 gm.

After my experience with Case 1, I determined to try the four-hour interval from the beginning. The baby was given diluted mother's milk for the first four days, was put to the breast every four hours from the first day, but would not nurse much till the fourth day when he took 64 c.c. in twenty-four hours and

thereafter obtained all his nourishment "by the sweat of his own brow." There were no digestive disturbances at any time.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	1,450	15	7	26‡	1,818	300	115
3	.....	30	..	28	1,889	...	...
4*	.....	64	..	30	1,932	...	...
5	1,392	40	20	32	2,089	...	...
7	1,390	72	36	36	2,188	...	..
11	1,448	135	65	38	2,273	...	...
14	1,562	167	75	40	2,300	...	...
16	1,622	175	75	42	2,314	...	...
18	1,655	215	90	44	2,370	...	...
20	1,700	215	88	46	2,442	...	...
22†	1,720	222	90	48	2,499	...	...
24	1,661	310	124	82	3,077	...	...

*Nursed.

†Baby taken home.

‡Amounts of food not recorded after this date, but the four-hour interval was maintained.

It is interesting to note in this case that the initial loss was only 60 gm. and that the baby began to gain when receiving only 65 calories of food per kilo of body weight (assuming 700 calories as the value of a liter of mother's milk). It will be noted also that he gained 272 gm. in eleven days, an average of 24 gm. per day on food of a caloric value per kilo of body weight of less than 100. There was a loss of 69 gm. on the twenty-sixth day when the baby was taken home.

CASE 3.—Baby E., born May 29, 1911; thirty weeks' gestation; weight 1,789 gm. Nursed every four hours from the first by a neighbor who came to the house for the first three days, after which the baby was taken half a block to her during the day and milk pumped from her breasts was fed at night. The mother had very little milk when the strong baby of the neighbor was put to the mother's breast to increase the milk secretion. The mother was soon able to nurse her baby at night and by the fifth week was able to furnish sufficient nourishment alone. This baby was weighed only once a week and showed a gain the first week. There probably was an initial loss during this week which was regained. The baby never vomited, never had colic nor a single attack of cyanosis nor digestive disturbance of any kind.

Age in Days	Weight, Gm.	Age in Days	Weight, Gm.
1	1,789	43	2,517
8	1,795	50	2,744
15	1,860	57	2,965
22	1,925	64	3,198
29	2,095	96	4,554
36	2,290		

CASE 4.—Baby boy W., born July 19, 1911. Birth weight 2,329 gm.

The intervals between feedings were four hours from the beginning. For the first four days diluted mother's milk was given; the baby being put to the breast every four hours for attempts at nursing. He nursed some on the fourth day and by the sixth was obtaining all his nourishment from the breast.

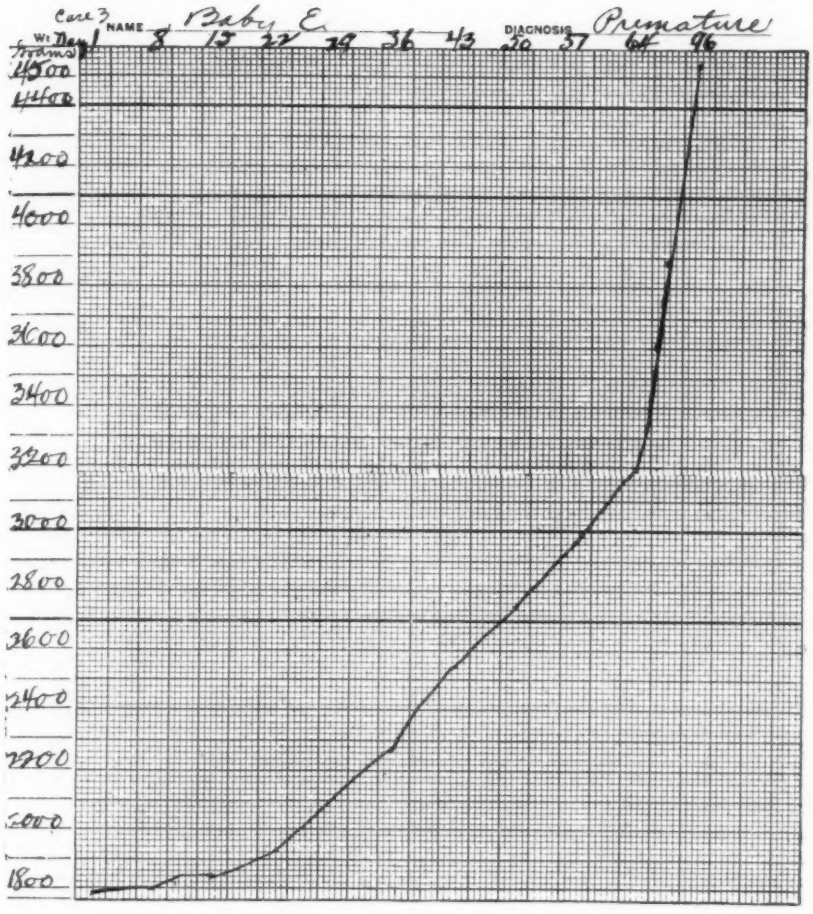

Chart 3.—Weight-Curve in Case 3

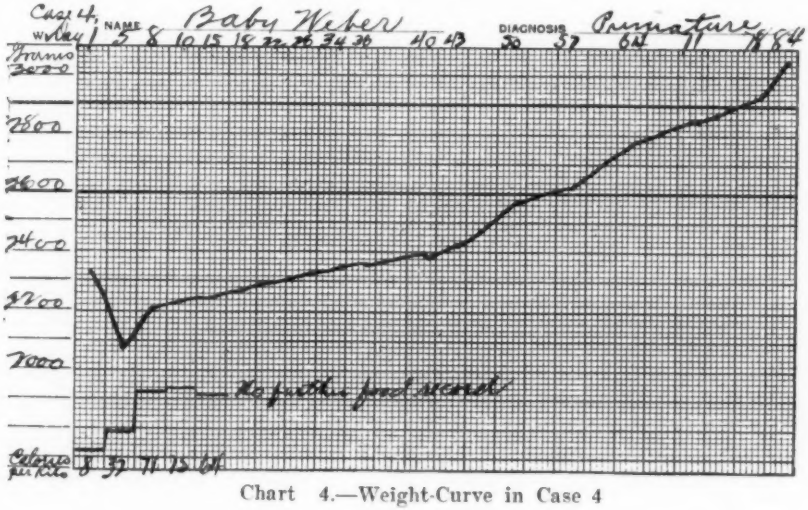

Chart 4.—Weight-Curve in Case 4

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	2,329	26	8	18‡	2,273	...	..
2	.....	52	..	22	2,291	...	..
3	.....	52	..	26	2,320	...	..
4	.....	45	..	29	2,340	...	..
5*	2,080	95	32	36	2,357	...	..
6	.....	170	..	40	2,386	...	..
7†	.....	186	..	43	2,415	...	..
8	2,205	225	71	50	2,571	...	..
9	.....	165	..	57	2,620	...	..
10	2,215	240	75	64	2,780	...	..
12	.....	190	..	71	2,845	...	..
13	.....	205	..	78	2,912	...	..
15	2,245	205	64	84	3,070	...	..

*Nursed some.

†Whole amount nursed.

‡Food amount not kept from this date when the mother left the hospital.

The initial loss in this case was 250 gm. but there were no digestive disturbances of any kind. The baby began to gain when the amount of food taken contained 71 calories per kilo of body weight and was still gaining when it was taken home, although the energy quotient had dropped to 64 calories per kilo of weight.

CASE 5.—Baby A., born Oct. 14, 1911.

The mother of this baby had convulsions on the train several hours before arriving in Minneapolis. She was in a comatose state when I delivered her by vaginal cesarean section of a toxic, asphyxiated baby weighing 2,065 gm. It was fed the usual equal parts of mother's milk and sterile water in slowly increasing amounts every four hours, being put to the breast at the same time. It began to nurse a little on the third day, taking a little more each day, but it was two weeks before it obtained all its nourishment by its own efforts.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	2,065	15	5	27	2,190	428	136
2	.....	33	..	29	2,270	470	140
4	1,936	37	13	32	2,308	418	126
6	1,945	64	23	34	2,425	488	141
8	1,910	103	37	36	2,515	460	128
12	1,950	178	64	38	2,603	527	141
14	1,975	205	72	41	2,693	598	155
16	2,030	188	64	44	2,925	647	154
18	2,020	155	53	47	3,070	530	119
19	2,015	172	60	49	3,093	693	156
20	2,007	209	72	52	3,190	672	147
21*	2,027	364	120	55	3,330	672	141
22	2,060	335	113	56	3,500	703	140
25	2,130	352	115	58	3,528	620	123

*Wet-nurse employed.

The initial loss in this case was 155 gm. It began to gain on the eleventh day when taking 64 calories of food per kilogram of body weight. It gained 110 gm. on food varying from 64 to 72 calories per kilo in four days, but it lost when the mother's milk began to decrease. On the twentieth day a wet-nurse was employed. The daily intake of food at once jumped from 209 gm. to 364 gm. in twenty-four hours. She was put first to her mother's breast and then to the wet-nurse and allowed to take all she would. The baby of the wet-nurse was used to stimulate

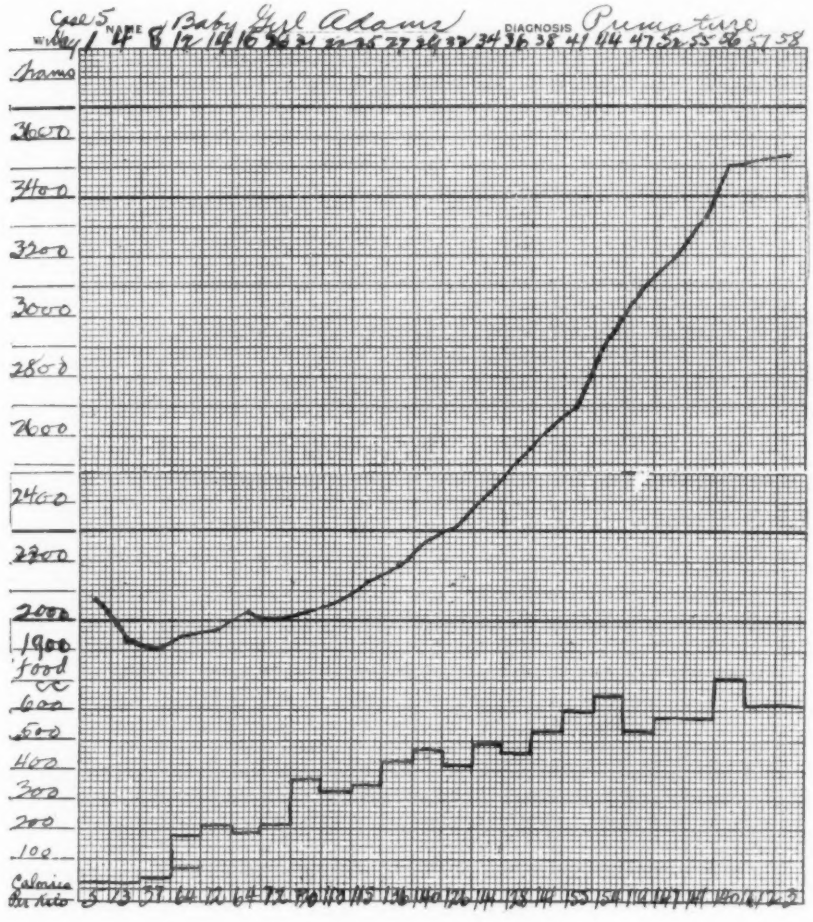

Chart 5.—Weight-Curve in Case 5

the mother's breasts. The calories per kilo of weight went to 120 and never dropped below 113. The gain was now very marked, gaining from 30 gm. to 60 gm. a day, and when the energy quotient went to 140, gained 90 gm. in a day. With these large amounts of food there were no digestive disturbances. This case illustrates that the relatively large amounts of food required by the premature can be obtained and digested even with the long interval.

CASE 6.—Baby boy T., born Dec. 6, 1911, birth weight 1,930 gm. Fed equal parts of mother's milk and sterile water every four hours till it could nurse, which was during the first week.

The initial loss was 270 gm. and was arrested on the fourteenth day. The loss stopped when the baby was receiving only 40 calories of food per kilogram of body weight, and began to gain when receiving 59 calories; it gained steadily, although slowly from the fifteenth to the thirty-seventh day, gaining 275 gm. in the twenty-two days on food running from 60 to 72 calories per kilo of body weight. This may be accounted for by the fact that the baby received a rela-

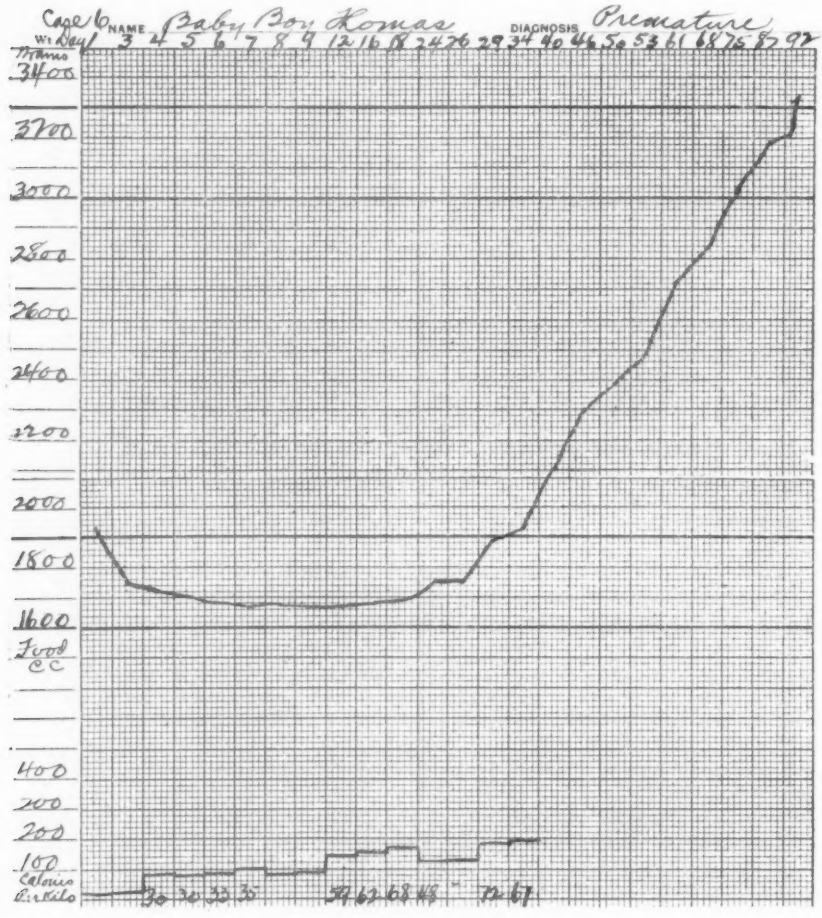

Chart 6.—Weight-Curve in Case 6

tively large amount of water, getting 50 per cent. to 60 per cent. as much water as it did milk. Probably this child would have gained more if it could have had more milk, but the mother did not have an abundance and none was available from other sources; however, the baby gained steadily and after going home the mother's milk increased and from that time on gained rapidly. There never was any digestive disturbance, vomiting or cyanosis. I wonder if this baby would have done as well if it had received less water or been fed more frequently.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	1,930	24	8	20	.....	120	..
2	.....	57	..	21	.....	115	..
3	1,740	59	23	23	.....	120	..
4	1,720	90	30	24	1,752	120	48
5	1,700	80	33	25	.....	120	50
6	1,678	85	35	26	1,746	125	..
7	1,665	98	41	28	1,650	170	72
8	1,670	80	33	29	1,888	180	67
9	1,660	89	38	32	1,925	180	65
10	1,660	95	40	34	1,935	185	67
11	1,660	110	46	40*	2,100	...	...
12	1,660	140	59	46	2,300	...	...
13	1,670	140	58	50	2,385	...	...
14	1,670	135	56	53	2,485	...	...
15	1,675	143	59	61	2,730	...	...
16	1,675	148	62	68	2,868	...	...
17	1,685	168	69	75	3,029	...	...
18	1,685	165	68	82	3,190	...	...
19	.....	123	..	92	3,337	...	...

*No record of amount of food after this date; intervals of feeding four hours.

CASE 7.—Baby girl A., born Oct. 17, 1911. Premature delivery at the University of Minnesota Hospital on account of severe infection of the mother's face after extraction of a tooth.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1*	1,835	..	..	28¶	1,820	...	37
2	.....	15	..	30	1,880	...	..
3**	.....	35	..	31	1,885	...	..
6†	1,710	39	16	33	1,850	...	..
8	1,685	92	33	35	1,855	...	..
10	1,675	123	51	36	1,870	...	..
11	1,695	140	51	37	1,860	...	..
14††	1,695	95	39	38	1,890	...	..
18	1,710	..	..	50	2,050	...	..
20‡ ..	1,775	152	60	60	2,300	...	..
22§	1,840	120	45	70	2,560	...	..
24	1,845	100	..	80	2,730	...	..
25§	1,855	120	45	97	2,805	...	..
27	1,870	100	37				

*Unable to swallow or nurse, fed through nostrils.

**Swallowed readily, vomited, nursed from bottle.

†Nursed a little and fed up to amount recorded.

††Nursed entire amount.

‡Nursed, 85 gm.

§Vomited.

¶Nursed poorly. No human milk available from other source. Human milk brought to hospital from distance by grandmother.

Discharged from hospital. The baby was carried some distance to a neighbor who nursed her every four hours. After three weeks the neighbor could not nurse the baby longer so the baby was taken to the service of Dr. Sedgwick at the University of Minnesota Free Dispensary where she was given the following formula:

One-third raw milk and two-thirds sugar solution (5 per cent.).

Dr. Sedgwick being also a believer in the long interval feeding the four-hour interval was maintained. The next two cases are reported to me by my colleague in the Department of Obstetrics and Gynecology in the University of Minnesota, Dr. F. L. Adair, who is also a believer in the long interval feeding of premature infants.

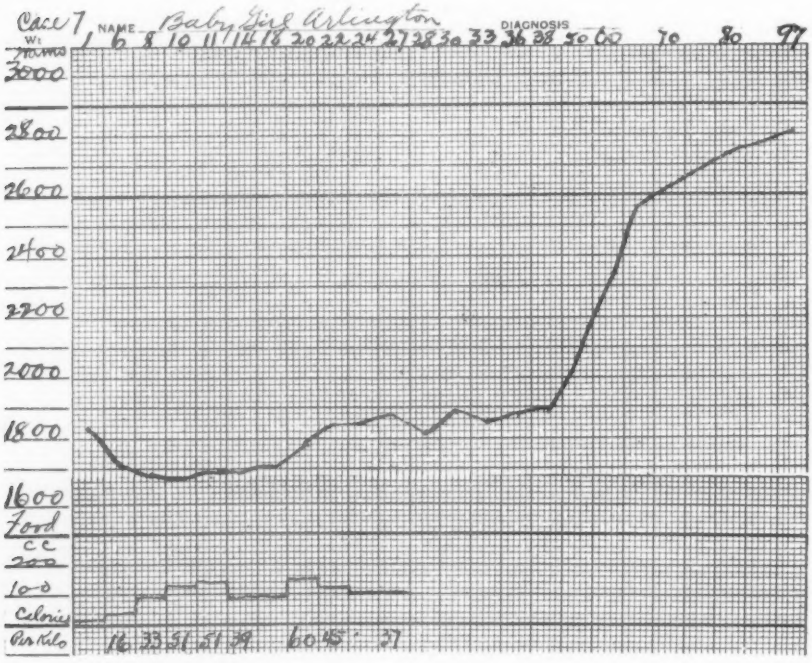

Chart 7.—Weight-Curve in Case 7

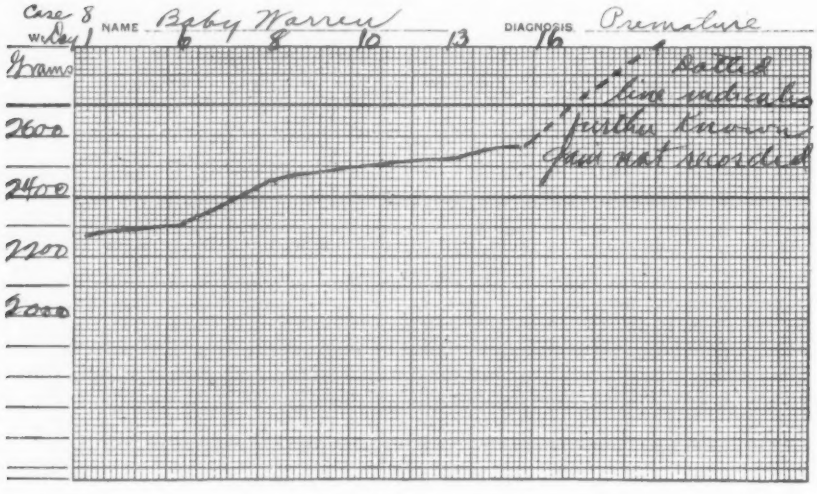

Chart 8.—Weight-Curve in Case 8

CASE 8.—Baby W., born June 27; weight 2,272 gm. Fed every four hours.

Age in Days	Weight, Gm.	Age in Days	Weight, Gm.
1	2,272	10	2,500
6	2,300	13	2,528
8	2,457	16	2,570

No further records are available but it is known that this baby continued to gain without interruption and was entirely free from any digestive troubles.

CASE 9.—Baby Champion, born October 13, weight 1,477 gm.

Age in Days	Weight	Food, c.c.	Age in Days	Weight	Food, c.c
1	1,477	..	8	1,477	..
2*	.....	..	11	1,477	..
3†	.....	11	16	1,533	..
5‡	.....	15	19	1,533	..
7§	.....	..	26	1,874	..

*Would not nurse.

†11 c.c. fed. Nursed well.

‡15 c.c. fed and nursed well.

§Nursed till satisfied.

No further record, but know that the baby continued to gain, had no complications and became a normal, healthy infant.

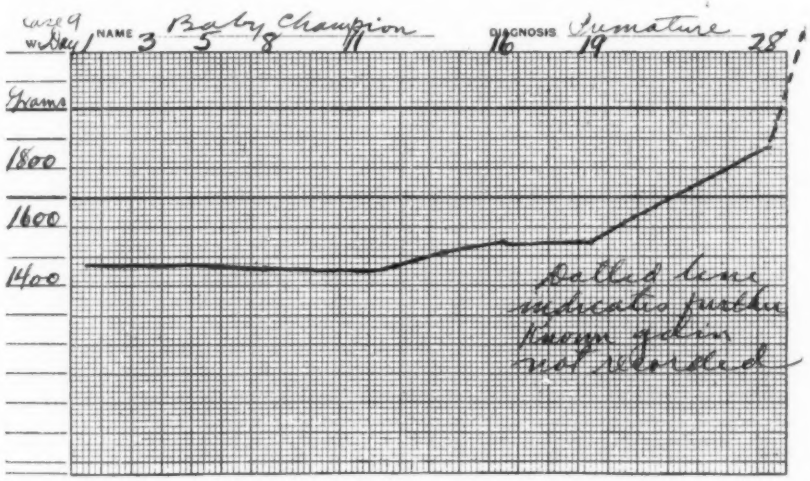

Chart 9.—Weight-Curve in Case 9

The following six cases were observed by my colleague, Dr. F. W. Schlutz, of the department of pediatrics in the University of Minnesota. He studied them in the Auguste Victoria Haus in Charlottenburg, Berlin, under the direction of Keller, who with Czerny, is a firm believer in the long interval feeding of premature infants.

CASE 10.—Elfride P., one of twins, born Sept. 13, 1909; birth-weight 1,680 gm.; fed breast milk every five hours from birth. At first the milk was pumped and fed, but the baby was nursing by the end of the second week.

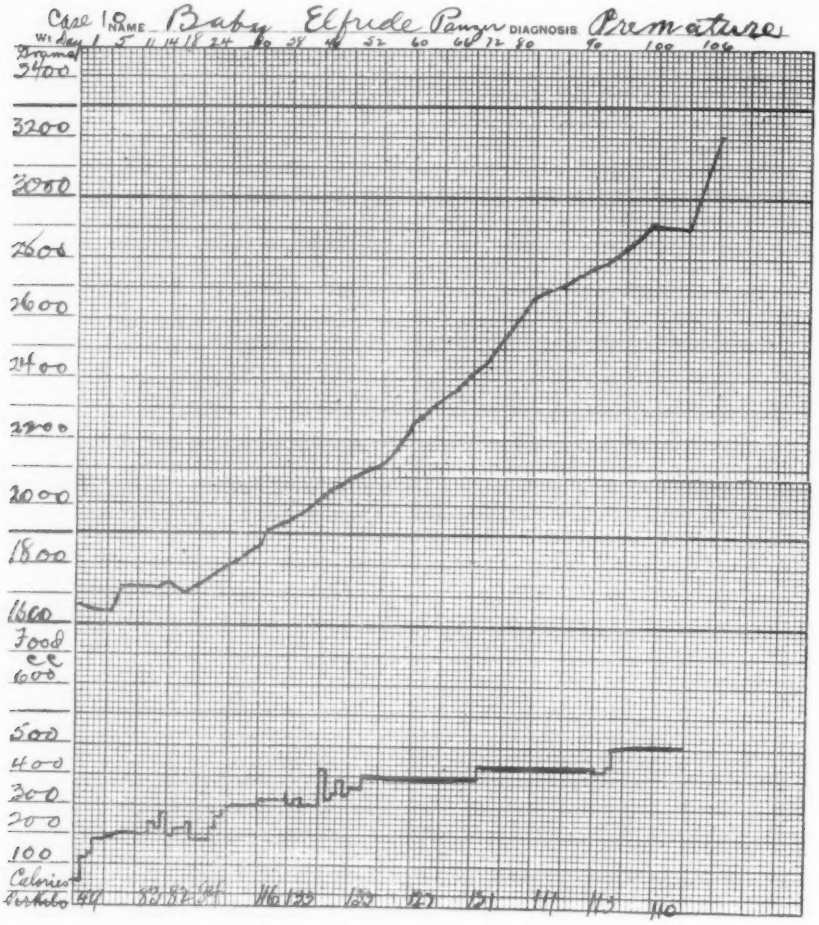

Chart 10.—Weight-Curve in Case 10

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	1,680	40	49	30	1,810	300	116
2	1,690	120	..	32	1,825	240	...
4	1,680	190	..	34	1,860	260	...
6	1,680	195	..	38	1,900	310	114
8	1,645	190	..	40	1,920	365	133
10	1,680	200	83	43	1,940	410	147
12	1,695	200	..	46	2,000	380	133
14	1,710	220	..	48	2,015	350	...
15*	1,720	260	..	52	2,100	400	112
16	1,720	200	82	60	2,200	400	135
18	1,700	220	..	65	2,300	400	127
20	1,710	240	..	70	2,400	450	117
21	1,740	190	84	75	2,500	450	131
24	1,740	210	..	83	2,660	450	126
26	1,745	245	..	90	2,760	450	111
28	1,765	270	..	95	2,800	440	113
*First day of nursing.				100	2,960	500	110

At this stage artificial feeding was gradually substituted for breast milk, the gain going steadily on after a loss of 80 gm., when the breast was entirely discontinued.

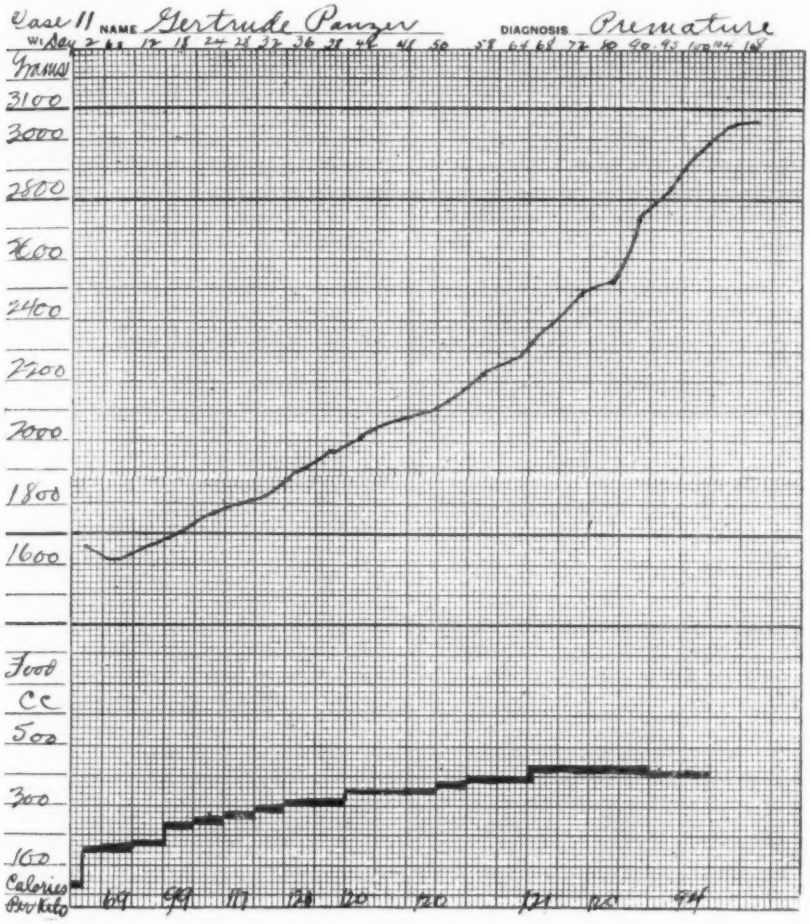

Chart 11.—Weight-Curve in Case 11

CASE 11.—Gertrude P., twin sister of Case 10. Birth weight 1,680 gm. Fed at five-hour intervals from birth.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	1,680	30	..	30	1,800	300	117
2	1,660	145	..	34	1,900	315	...
4	1,690	100	..	40	1,960	345	120
6	1,635	160	..	46	2,020	340	...
8	1,620	160	69	50	2,060	360	120
10	1,690	200	82	54	2,150	400	125
14	1,690	240	..	60	2,220	400	126
16	1,695	220	99	65	2,300	400	121
18	1,700	240	..	70	2,420	440	131
20	1,720	250	...	80	2,530	440	121
24	1,760	260	103	90	2,745	420	106
26	1,790	300	...	100	2,980	400	94

As in Case 10 artificial feeding was gradually substituted with a loss of a few grams when breast feeding was entirely discontinued, followed by a steady gain

CASE 12.—Kurt S., born Jan. 11, 1909, birth weight 2,340 gm.

This child was fed albumin milk at two and a half hour intervals at first, later increased to three and then to four hour intervals. The baby was in miserable condition on admission.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Per cent. Dextri Maltose Added	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Per cent. Dextri Maltose Added
1	2,340	290	112	1	17	2,200	500	119	..
3	2,440	400	...	..	19	2,120	500	165	..
4	2,400	400	...	..	23	2,200	500	151	..
5	2,300	400	...	..	29	2,340	500	143	..
6	2,190	400	...	..	31	2,460	500	142	..
10	2,100	400	128	2	39	2,540	600	...	4
11	2,090	480	...	..	41	2,620	600	160	..
13	2,100	500	169	3	47	2,725	600	154	..

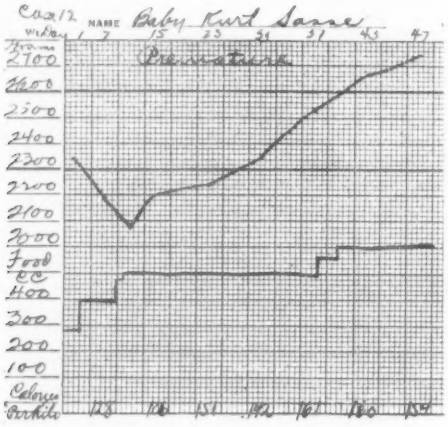

Chart 12.—Weight-Curve in Case 12

It will be noted here the greater quantity of food required and the irregularity of the weight curve when artificial food is used.

CASE 13.—George S., twin brother of Case 12, fed with the same food at two and a half hour intervals, later increased to three.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1*	2,540	280	77	20	2,460	500	134
3†	2,500	400	112	22	2,540	500	141
8	2,400	400	...	24	2,500	585	140
10‡	2,440	400	114	25	2,600	600	163
12	2,420	480	134	30	2,690	600	161
16	2,500	500	...	35	2,740	640	163
18	2,600	500	140				

*Albumin milk.
†1 per cent. dextri maltose added.
‡2 per cent. dextri maltose added.

Another illustration of how much more difficult artificial feeding is than feeding on the breast.

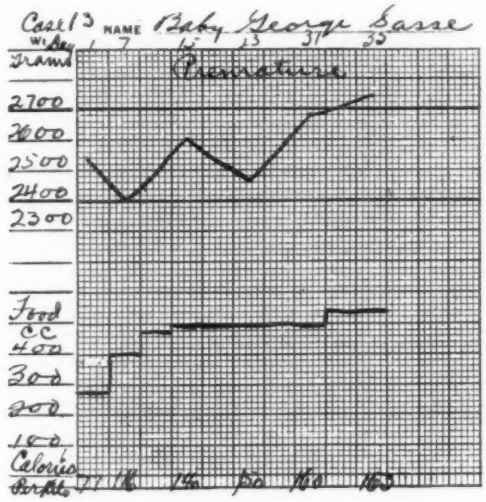

Chart 13.—Weight-Curve in Case 13

CASE 14.—Franzeska S., birth weight 2,500 gm., fed every four and later every five hours on artificial food—oatmeal-water, buttermilk with varying percentages of dextri maltose cane-sugar and Liebig's malt extract, but inasmuch as we are not

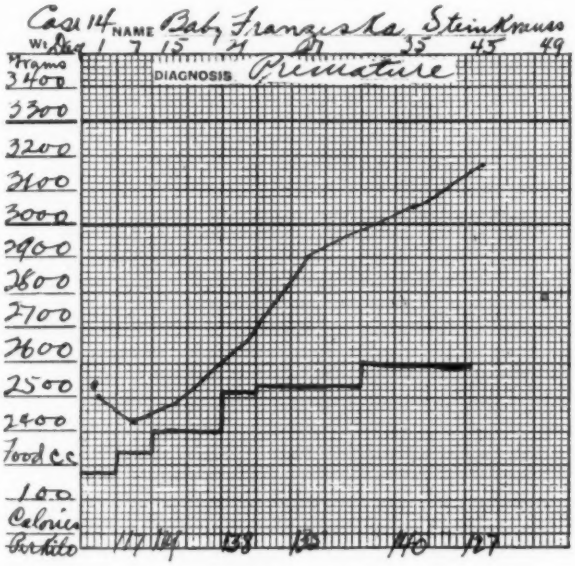

Chart 14.—Weight-Curve in Case 14

discussing the value of different artificial foods I will deal only with the quantities and caloric values.

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	2,500	30	..	22	2,660	525	..
2	2,500	180	..	26	2,800	540	135
4	2,480	220	79	30	2,900	600	145
6	2,500	280	78	32	3,000	600	140
8	2,460	400	113	38	3,120	600	134
12	2,480	420	119	45	3,300	600	127
18	2,580	510	138				

This case shows that with carefully regulated artificial feeding given at long intervals a continuous rapid gain is possible.

CASE 15.—Elsie S., twin sister of Case 13, fed in the same manner. Birth weight 2,140 gm.

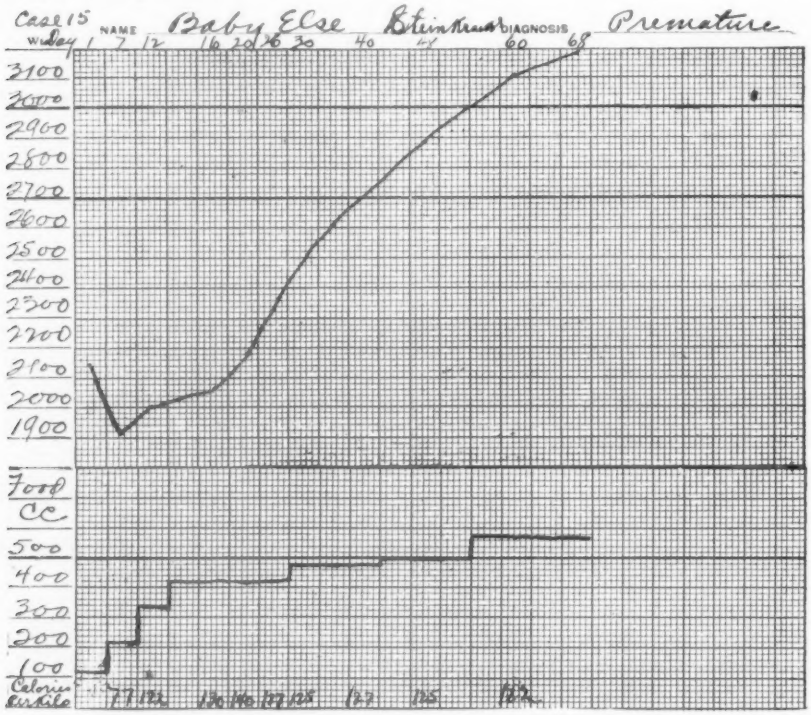

Chart 15.—Weight-Curve in Case 15

Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight	Age in Days	Weight, Gm.	Food per Day, c.c.	Calories per Kilo of Body Weight
1	2,140	20	..	32	2,440	420	125
3	1,910	120	77	35	2,500	420	117
6	2,000	220	108	40	2,600	480	129
8	2,060	320	122	42	2,700	480	120
12	2,010	350	130	48	2,810	500	125
15	1,950	360	122	53	2,900	510	123
20	2,100	420	140	58	3,000	570	118
24	2,180	420	130	62	3,140	570	127
26	2,300	420	127				

I realize that this series is too small to permit of any positive conclusions, but the cases do show that premature babies may be successfully nourished with long interval feeding and with a minimum of digestive troubles, and in my experience with much less disturbance than with frequent feeding. The amount of care that these babies require is greatly reduced by this method of feeding. We know that the less they are handled the better the premature infant progresses. It is evident that if they are fed only every four hours they will be handled half as much, and consequently they have more time to sleep, and the long periods of sleep was one of the characteristic things about the babies of this series. The nurses have remarked about the simplicity of the care over the older method.

It may be only a coincidence, or due to the small number of cases, but not one case of this series had digestive trouble, vomiting, cyanosis or persistent green stools, except Case 1, before the long intervals were employed, and Case 7, in which we had difficulty in obtaining enough mother's milk. The vomiting in this case being due, as Budin has pointed out, to insufficient food, stopping as soon as enough food was obtained.

In searching the literature I find scant support for the long interval feeding, but what little there is, is from an eminent source. To quote from Czerny and Keller:[1]

> We allow the premature child no more than six meals a day (every four hours) of mother's milk, and no more than five in the case of artificial feeding. We take a stand in this respect contrary to that of almost all authors who, on account of fear of underfeeding, feed the premature baby still oftener than the mature, often hourly or half hourly. All of the reasons which we have given for feeding the mature baby at long intervals have even more weight in the case of the premature. One can determine by the scales that the quantity of nourishment which the premature baby nurses spontaneously is insufficient, and on that account loses weight; this is no reason for increasing the number of meals but, on the contrary, is reason for increasing the size of the single meal by instilling a definite amount of milk in addition to that spontaneously taken.

The weight curves of the babies in this series certainly show that a constant steady gain is possible by this method of feeding.

Inasmuch as we are limiting the discussion in this paper primarily to the feeding intervals, the question of the amount of food necessary to the proper development of the premature infant would have no place were it not that the short interval is employed through fear of under-feeding on account of the fact that the nourishment needs of the premature child are relatively larger than of the mature. The question then naturally arises as to whether it is possible for the premature child to obtain the necessarily large amount of nourishment if the long interval is employed.

1. Czerny and Keller: Ernährung des gesunden Kindes, p. 685.

Budin[2] asserts that at the tenth day of life the baby should be receiving about one-fifth or one-sixth of its body weight in food. Delestre[3] substantially agrees with Budin, asserting that premature babies weighing under 1,500 gm. should receive by the tenth day, 250 gm., and over 1,500 gm. should get 350 gm.

Our Cases 2, 3 and 5 began to gain on food amounting to only one-tenth of the body weight and continued to gain on one-eighth to one-ninth, and Case 6 began to gain on one-eleventh and continued to gain on one-ninth and one-tenth. Cases 10 and 11 were receiving one-eighth when they began to gain and the progress was maintained on one-sixth to one-seventh. Cases 12, 13, 14 and 15 were fed artificially and received one-sixth, one-ninth and one-fifth, respectively. There is not a great abundance of evidence in the literature as to how much the premature infant should receive after the tenth day, but most authors recommend about one-fifth of the body weight in twenty-four hours, or 120 to 140 calories of food per kilogram of body weight.

Hess[4] believes that the caloric needs vary inversely with the age and birth weight, the energy quotient ranging from 115 to 170 in those below 1,500 gm., and 100 to 132 in those over 1,500 gm.

Morse[5] draws the wise conclusion that the contradictory figures of various authors as to the caloric needs of premature babies at different ages seemed to depend as much, or more, on the digestion and metabolism of the given baby, at the given age as on the amount of food, the age of the baby or any inherent differences in the individual babies.

Heubner[6] avers that an energy quotient of less than 70 is insufficient.

As I have shown in the analysis of the individual cases, these babies can take the required amount of food without difficulty or digestive disturbance.

Case 2 took 310 c.c., or 124 calories per kilo, at the twenty-fourth day without difficulty; Case 4 took 240 c.c., an energy quotient of 75 by the tenth day; Case 5 took 205 c.c., energy quotient of 72 by the fourteenth day, and by the twenty-ninth day took 470 c.c. (energy quotient 240) and never was disturbed; Cases 10 and 11 were taking 200 c.c., and Cases 12, 13 and 14, 400 c.c., and Case 15, 350 c.c. at the tenth day, showing that the large amount of food needed can be taken without difficulty.

While these deductions by the authors of the food need are valuable, they are at best not much more than good guides as to what to attempt, for in the last analysis the weight curve and digestive ability of the individual child must be the real criterion.

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2. Budin: Manuel pratique d'allaitement, p. 87. Paris, 1905.
3. Delestre: Thèse de Paris, 1901.
4. Hess: Am. Jour. Dis. Child., November, 1911.
5. Morse: Am. Jour. Med. Sc., cxxvii, 471.
6. Heubner: Ztschr. f. Diätet. u. physik. Therap., 1901, v, 13.

According to these standards our babies certainly progressed very well, for they all gained continuously and never had any digestive troubles of any kind and were far less care than if they had been fed frequently. What more could be asked?

CONCLUSIONS

1. Long interval feeding of premature infants is feasible.
2. The relatively large amount of nourishment required can be given without trouble.
3. In this series the digestive and other disturbances were less than in other cases in which the short intervals were used.
4. The weight increased as rapidly as by the other method.
5. The infants slept more and longer and were much easier to care for.
6. The best interval seems to be four hours.

I wish to acknowledge my gratitude to Drs. Adair and Schlutz for valuable aid.

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PROGRESS IN PEDIATRICS

RESPIRATORY SYSTEM

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ST. LOUIS

RESPIRATION

Ssokolow[1] has constructed an instrument which he calls a differential pneumograph, by means of which the respiratory excursion of different parts of the chest is registered on a kymograph. Tracings taken from cases are shown and some of these are accompanied by radiographs showing the intrathoracic conditions which were present. By means of the instrument the restricted excursion of one side of the chest in case of tuberculosis of the lungs is graphically contrasted with the movement of the opposite side. Ssokolow[2] has also described a method of artificial respiration which he has used with success for a number of years in asphyxia of the newborn, and in other conditions requiring artificial respiration. He thinks the method is of more service and less likely to produce mechanical injury than any of the other methods in use.

By means of a specially constructed spirometer, Lederer and Vogt[3] investigated the respiratory volume in infants and the effect of certain drugs on the volume. The investigations were carried on during sleep in order to avoid psychic disturbances. They found in infants that the average amount of air inspired in a single respiration is greater in sleep than when awake, but that this difference does not occur in older children. The depth of single inspirations increases from birth on. The amount of air inspired during a period of one minute (Atmungsgrosse) decreases during the first year of life and later remains at an almost stationary figure. The influence of alcohol was investigated, but without any very definite results being obtained. The authors think that their results indicate that alcohol has the tendency to increase the respiratory volume. In cases of chronic lung disease (bronchiectasis) the volume of air inspired was less than in normal children. They found that when the volume of the respiration increases in a normal child, the respiratory rate diminishes. In cases of chronic lung disease, on the other hand, the frequency of the respirations remains the same or even increases when the volume of air inspired is increased.

1. Ssokolow: Jahrb. f. Kinderh., 1912, xxv, 265.
2. Ssokolow: Monatschr. f. Kinderh., 1911, x, 457.
3. Lederer and Vogt: Jahrb. f. Kinderh., 1912, xxv, 1.

Conner and Stillman[4] studied the respiratory rhythm in meningitis by means of a Marey pneumograph. In all, 43 cases were studied which included 19 cases occurring in infants and 11 in older children. Of the 43 cases, 39 were tuberculous. They noted three types of irregularities: 1. An undulatory type, characterized by more or less rhythmical variations in the force of respirations, and in the tonicity of the respiratory muscles. This was noted at some time in the course of almost every case. 2. Biot's breathing. This was noted in 27 per cent. of the cases, but was more common in adults and in non-tuberculous cases. Biot's breathing shows a constant irregularity in the force and rhythm of the individual respirations, while periods of apnea of varying length occur at irregular intervals. Deep sighing respirations occur frequently. 3. Cheyne-Stokes respiration. This was observed in 19 (63 per cent.) of the 30 cases occurring in infants and children, and was more commonly associated with tuberculous meningitis. In infants and young children Cheyne-Stokes respiration presents certain features which distinguish it sharply from the Cheyne-Stokes respiration of adults. This, which they call the *infantile type,* they consider to be the same as the "grouped respirations" described by West. The peculiarities are described as follows: The duration of a complete cycle (respiratory period and period of apnea) is much shortened—the average time being ten seconds in contrast with the average time of one minute for a cycle in an adult. The number of respirations in each period is smaller, averaging from 4 to 5. The time of the period of apnea is relatively long and occupies one-half of the cycle, while in the adult type the respiratory period is twice the length of the period of apnea. The force and amplitude of the respiratory movements are less, and the gradual increase of amplitude followed by a gradual decrease is not so common. At times all of the respirations have practically the same amplitude in the infantile type.

THYMIC ASTHMA

During recent years the reports of a number of cases of hypertrophy of the thymus which have been treated by the *x*-ray have appeared in literature. Friedlander[5] has studied the action of the *x*-ray on the thymus gland in litters of young rabbits, and has found that involution may be brought about in varying degrees of rapidity according to the number and frequency of exposures. Some reduction in size of the spleen occurs at the same time even when the splenic area is shut off from exposure to the rays. From his clinical and experimental studies Friedlander believes that exposure to the *x*-rays is a better and safer method of treatment of hypertrophied thymus than thymectony, as the latter may produce severe metabolic disturbances.

4. Conner and Stillman: Arch. Int. Med., 1912, ix, 203.
5. Friedlander: Arch. Pediat., 1911, xxviii, 811.

In a discussion of thymic death—cases of sudden death occurring in infants or children in which an enlarged thymus is found, although no symptoms of enlargement have been present—Ssokolow[6] takes the position that the enlarged thymus is not the cause of the death except in that it may be a sign of some underlying metabolic disturbance which is itself the cause of the death. That is, there is no such thing as thymic death without thymic asthma, although there is thymic asthma without thymic death. A number of cases are reported of dyspnea with hypertrophy of the thymus, and the author concludes that thymic asthma is a clinical entity due to the pressure of an enlarged thymus on the trachea. A rather unusual cause of enlargement of the thymus was reported by Kennedy,[7] who found a thymus weighing 2½ ounces in a child dying of cardiac failure. Histologically the enlargement was due to an angiomatous condition of the thymus.

TRACHEOBRONCHIAL ADENOPATHY

Greult[8] discusses the production, frequency and clinical importance of lesions of the tracheobronchial lymph-nodes. He states that enlargement is by no means always tuberculous in nature, and that marked swelling occurs in pertussis and in typhoid fever. Whether tubercular enlargement is primary or secondary is a question that is not yet definitely decided. The author thinks that even slight compression of the air passages by enlarged glands produces a respiratory murmur which is almost constantly present.

Maillet,[9] in an interesting, although somewhat hypothetical article, discusses the acute accidents or complications which may appear in the course of tracheobronchial adenopathy. He divides these into respiratory, circulatory and digestive crises. The respiratory crises are the most common and best known and appear in two chief forms, spasm of the glottis and asthmatic attacks. The acute attacks have a sudden onset and last for an indefinite period of time. Clinically the subject of an attack is dyspneic, respirations are rapid and a stridor is present. The stridor may be inspiratory alone, or it may be accompanied by an expiratory stridor. Frequently the attacks are accompanied or followed by bronchitis and congestion, and sometimes by bronchopneumonia. Maillet considers that these acute attacks are the result of pressure of the enlarged glands on the vagus nerve or its branches. The attack may so simulate thymic asthma that it is almost impossible to distinguish the two. The dyspnea, alterations in breath sounds, and area of impaired resonance anteriorly, may be the same in both conditions. Even a radio-

6. Ssokolow: Arch. f. Kinderh., 1912, lvii, 1.
7. Kennedy: Glasgow Med. Jour., 1912, lxxii, 31.
8. Greult: Ann. de méd. et Chir. inf., 1911, xv, 497.
9. Maillet: Arch. d. méd. d. enf., 1912, xv, 193.

graph may be unable to help the diagnosis. The author states that the most important clinical sign pointing to enlarged glands rather than enlarged thymus is an area of impaired resonance posteriorly in the area over the bronchial lymph-nodes. Less commonly crises occur in which cyanosis, hemorrhage from the nose or pulmonary hemorrhage, or pulmonary edema occurs, and these attacks Maillet considers the result of vascular compression and calls circulatory accident. Certain cases of vomiting in which no distinctive signs of gastric disturbance are present, but in which the signs of enlarged bronchial glands are found on examination, the author considers as a result of the adenopathy and classifies as digestive crises.

ASTHMA

Knopf,[10] in a discussion of asthma in childhood considers asthma as a symptom-complex rather than a disease *sui generis*. He bases his views on the failure to find any features peculiar to asthma and the lack of an anatomic basis for the condition. He looks on the symptom-complex as a neurosis which has its origin in a congenital weakness and hyperexcitability of the nervous system. Anxiety plays an important part in the etiology. The attacks symptomatically are a faulty coordination in the musculature of the respiratory system, so that muscles which should act as synergists act as antagonists, with the result that the effect of the strong muscular exertion is nullified. It is essential in the treatment to correct the underlying neurotic element and for this purpose it may be best to have the patient in a sanatorium. Breathing exercises accompanied by massage give better results in children than any medicine. In five cases of asthma in children, Knopf has had a symptomatic cure for over a year.

Comby[11] has observed 75 cases of asthma in infants and children and gives some interesting figures. The onset of the first asthmatic attack appeared 9 times in the first 6 months of life, 15 times between 6 and 12 months, 32 times between 1 and 3 years, 9 times between 3 and 6 years, and 10 times after 6 years. Of the 75 cases 43 were in boys and 32 in girls. In 21 cases there was a history of asthma in the parents of the child and in 16 cases in the grandparents. It was more common in children coming from families of the better classes, and especially from families with rheumatic or gouty tendencies. Comby looks on asthma in the infant as a manifestation of a neuro-arthritic diathesis, and it is frequently accompanied by other signs of this condition, as migraine. In 28 of the 75 cases there was a previous history of eczema. True asthma is never caused by adenoid growths nor has it any relation to tuberculosis.

10 Knopf: Ztschr. f. Kinderh., 1912, ii, Ref., p. 756.

11. Comby: Arch. d. méd. d. enf., 1911, xiv, 721.

BRONCHIECTASIS

Vogt[12] reports twenty-two cases of chronic respiratory disease in children in which he believes the lesion present to be bronchiectasis and discusses the condition in some detail. In these cases it is usual to find the history of a chronic bronchopneumonia or a chronic or recurrent acute bronchitis. The patients present a picture of general ill health, together with a chronic cough with expectoration. On physical examination areas are found over which râles are inconstantly present and occasionally increased respiratory sounds are heard. If there has been an old pleurisy there may be slight impairment of resonance. The picture is very similar to that of tuberculosis and Vogt believes that this is frequently erroneously diagnosed. It is best distinguished by the failure to find tubercle bacilli in the sputum on repeated examination. In some cases with dilated bronchioles, which have come to autopsy through some intercurrent disease, Vogt has found the influenza bacillus and considers this organism of importance in the etiology. In the majority of cases which follow a chronic bronchopneumonia the dilatation of the bronchi is due to a contraction of the lung with scar tissue formation or to an inflammatory destruction of the elastic and muscular tissue of the walls of the bronchi.

Fisher[13] considers recurrent attacks of bronchitis to be the most common chronic lung disease of childhood and believes that they frequently lead to bronchiectasis. He thinks that bronchiectasis is frequently a sequel of measles, more so than is tuberculosis. He does not believe that pertussis or enlarged bronchial glands are common causes of bronchiectasis.

Buchmann[14] investigated a number of cases of fetal atelectasis with secondary bronchiectasis in the area surrounding the atelectasis. Clinically these areas can only be recognized through the secondary bronchiectasis. The pleura over the atelectatic areas was thickened and showed a loss of pigment. Numerous muscle fibers were found in the interstitial tissue about the bronchiectatic cavities. No tuberculous lesions were found in the patients examined by the author.

PNEUMONIA

Numerous attempts have been made to produce pneumonia experimentally, but it has never been accomplished with any degree of success until the past year. Lamar and Meltzer,[15] by means of intratracheal insufflation of pure cultures of pneumococci, were able to produce pneumonia successively in forty-two dogs. There was a mortality of 16 per cent., and in the fatal cases the lesions closely resembled those occurring

12. Vogt: Jahrb. f. Kinderh., 1911, lxxiv, 627.
13. Fisher: Clin. Jour., 1911-12, xxxix, 410.
14. Buchmann: Frankfort Ztschr. f. Path., 1911, viii, 263.
15. Lamar and Meltzer: Jour. Exper. Med., 1912, xv, 133.

in man. Clinically the non-fatal cases ran a shorter and milder course than the pneumonia occurring in man. The quantity of the culture seemed to bear a relationship to the outcome of the disease as in the fatal cases larger quantities of pneumococci were used. The authors think that the successful results were due to the obliteration of the smaller bronchi by the injected culture, which permitted the organisms to display their pathogenic activities. Wollstein and Meltzer[16] continued the work, using cultures of streptococci and the influenza bacillus, and produced a lesion resembling the bronchopneumonia of man and differing materially from the lesion produced by the pneumococcus. In the experiments the animals used were not selected, and hence the authors are led to believe that the proper invasion of the organism is the determining factor in the production of a pneumonia. Furthermore, that in all probability different types of pneumonia are produced by specifically different bacteria. Whether or not the degree of virulence of the causative organisms bears a relationship to the type of pneumonia lesion produced remains for future investigation.

Hutchinson,[17] in a discussion of the pneumonias of childhood, divides them into primary and secondary. He defines primary pneumonia as those cases in which the inflammation starts in the lung substances, and secondary as those in which it starts in the air passages (bronchopneumonia). Primary pneumonia may be lobar or lobular in its distribution and is practically always due to the pneumococcus. Its maximum incidence as regards age is between 1 and 2 years. The onset is usually abrupt, although often deceptive, as an attack may be ushered in by vomiting or simply drowsiness of the child. Fever and shivering may occur and convulsions are not uncommon, but a true chill is unusual. Very characteristic is the altered respiration—increase of rate frequently out of proportion to the pulse, with inversion of the respiratory rhythm (pause after inspiration). The physical signs are often absent in beginning pneumonia in children, and rarely the signs do not become manifest until the crisis is past. Impaired resonance is an important sign, and in obtaining this Hutchinson urges the value and necessity of using very light percussion. The symptoms are usually less pronounced in children than in adults, as children do not seem to suffer so much from the toxemia. Heart failure is a rare occurrence in childhood. As a rule primary pneumonia terminates by crisis on the seventh or eighth day, but it is not infrequent to have pseudo-crises. In these, however, the respiratory rate does not fall as it does in the true crises. After a crisis it is not uncommon to have an unstable temperature in children. Persistent cases may be due to protraction or there may be a spreading

16. Wollstein and Meltzer: Jour. Exper. Med., 1912, xvi, 126.
17. Hutchinson: Clin. Jour., 1912, xxxix, 289.

or relapsing of the primary focus of inflammation. The prognosis usually is good, and the author summarizes his treatment by saying that his cases "get really nothing which can be described as treatment at all, and I find that they do very well without it."

Niles and Meara[18] report a case of lobar pneumonia in a boy of 14 years, which was due to infection with the *Micrococcus catarrhalis*. Blood cultures and cultures from a pleural exudate were sterile, but pure cultures of this organism were obtained from the sputum. Trevisanello[19] obtained pure cultures of Fraenkel's diplococcus from herpetic lesions in two cases of pneumonia. Implantation of the organisms on the skin of another patient produced an herpetic eruption. The organisms were of low virulence, but the author thinks they may be capable of infecting susceptible individuals.

A case of probable antenatal pneumonia was reported by Macdonald,[20] the history of which was as follows: On the 17th of the month a woman at term was admitted to the hospital suffering with pneumonia. Two days later she gave birth to a female infant weighing 6 pounds. The baby was cyanosed, but cried shortly after birth. All that day the infant had difficulty in breathing and died twenty-eight days after delivery. At necropsy the upper and lower lobes of the right lung were found in a stage of red hepatization, and from the lesion cultures of pneumococci were obtained. The author thinks that from the advanced stage of the lesions found the infection must have occurred through the placental circulation before birth.

By means of a Faught sphygmomanometer, Howland and Hoobler[21] determined the effect of cold fresh air on the blood-pressure of children with pneumonia. When children with an active pneumonia were taken from the ward and exposed to cold air on a balcony there was a rise of blood-pressure, and return to a warm, although well ventilated ward, was followed by a fall. The rise is usually noticed about a half hour after the child is put out of doors, reaches its maximum in two hours, and is maintained for a number of hours afterwards. In convalescents the change in blood-pressure was less striking and in some cases did not occur. In warm weather no effect is obtained by putting the children out of doors, and hence the authors think that the coldness of the air is the important factor, and that its action is by a reflex stimulation of the vasomotor centers through the action of the cold air on the skin and nasal mucous membrane. Whether it is advantageous from the standpoint of the circulation to raise the blood-pressure of a child with pneumonia, whose blood-pressure is already at an average point, the authors are not

18. Niles and Meara: Amer. Jour. Med. Sc., 1911, cxlii, 803.
19. Trevisanello: Centralbl. f. Bakteriol., 1 Abt. Orig., 1911, lx, 69.
20. Macdonald: Brit. Med. Jour., 1911, ii. 1247.
21. Howland and Hoobler: AMER. JOUR. DIS. CHILD., 1912, iii, 294.

prepared to state. No bad effects were noted. The other beneficial effects of cold fresh air are not discussed in the paper.

EMPYEMA

In an article on the diagnosis of pleuritic effusions in infancy, Miller[22] draws attention to the fact that practically all pleural effusions in infancy are purulent. They are never primary and most commonly follow pneumonia. The general symptoms of a child with empyema are marked, but the physical signs are indefinite and variable. Vocal fremitus is of little value. Dulness on percussion is not always present. Bronchial breathing and râles are usually heard over an effusion. Exploratory puncture is the decisive and only sure means of diagnosing a pleural effusion. Next to this come dulness and a sense of resistance on percussion and displacement of the apex.

Zybell[23] reports 22 cases of empyema occurring in the first year of life and reviews the literature. In 14 of 20 cases examined the pneumococcus was found. Only 4 of the 22 cases were admitted to the hospital for pneumonia, but in practically all the pleural effusion was preceded or accompanied by pneumonia. He also considers exploratory puncture to be the most important and often the only useful means of diagnosis. The prognosis of empyema in infants is bad, and 15 of the 22 infants died. The cases which recovered were all among the older infants. In a discussion of the treatment Zybell is strongly in favor of aspiration or repeated puncture with a good sized cannula. He is opposed to a radical operation in infants (resection of a rib) and quotes a number of statistics to show that with resection the mortality is higher than in cases treated by aspiration or puncture. Kelly,[24] while in favor of drainage with children, notes that previous aspiration may be of benefit, and that in very young or very feeble infants simple incision under local anesthesia is better than resection of a rib.

1806 Locust Street.

22. Miller: Arch. Pediat., 1911, xxviii, 28.
23. Zybell: Monatschr. f. Kinderh., 1912, Orig. xi, 93.
24. Kelly: Amer. Jour. Surg., 1912, xxvi, 47.

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GENITO-URINARY SYSTEM

Albumin, Origin of, in Infant's Urine. (Herkunft des Harneiweisses bei Albuminurien der Säuglinge.)—N. Krasnogorski.
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Albuminuria, Orthostatic, Pathogenesis of.—B. Stiller.
Berl. klin. Wchnschr., Sept. 30, 1912.

Enuresis, Treatment of Nocturnal, in Children.—Mello-Leitao.
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Hemoglobinuria, Paroxysmal.—L. C. Ager.
Am. Jour. Dis. Child., November, 1912.

Horseshoe Kidney, Clinical Importance of.—D. N. Eisendrath.
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Hydronephrosis in Children.—H. Anscherlik.
Wien. klin. Wchnschr., Oct. 31, 1912.

Pyelitis in Infants, Dietetic Treatment of. (Zur "diatetischen Behandlung der eiterigen Erkrankungen der Harnwege im Säuglingsalter.)—H. Nothmann.
Berl. klin. Wchnschr., Sept. 23, 1912.

OSSEOUS SYSTEM

Bone Diseases in Children. Diagnosis of.—G. F. Little.
Am. Jour. Obst., October, 1912.

Hip-Joint Disease, Treatment of.—L. G. Bowers.
Ohio State Med. Jour., Oct. 15, 1912.

EYE, EAR, NOSE AND THROAT

Epistaxis. Mechanical Means to Arrest.—Ritschl.
München. med. Wchnschr., Oct. 22, 1912.

Eye, Ear, Nose and Throat in School Children, Importance of Care of.—J. Tomlinson.
Jour. Med. Soc. New Jersey, November, 1912.

Ophthalmia Neonatorum, Treatment of.—A. Brav.
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Ozena, Appeal for Participation of Pediatrists in International Collective Research on.—A. Alexander.
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School Children, Treatment of (London County Council) at Royal London Ophthalmic Hospital.—F. Moxon.
Brit. Med. Jour., Oct. 19, 1912.

Tonsil Surgery, Some Opinions Concerning.—C. C. Stephenson.
California State Jour. Med., November, 1912.

Tonsils, Enucleation of, with the Fingers. (Totale Enukleation der Gaumenmandeln.)—E. Borchers.
München. med. Wchnschr., Oct. 8, 1912.

Tonsillar Hemorrhage, Operative and Postoperative.—W. S. Franklin.
California State Jour. Med., November, 1912.

Tonsillotomy or Tonsillectomy, Which?—C. Joyes.
Texas State Jour. Med., October, 1912.

Tympanic Membrane, Defects in, in Children. (Ursachen des Offenbleibens und Vernarbens von Trommelfelllücken im Kindesalter.)—B. Gomperz.
Ztschr. f. Kinderh., Sept. 10, 1912.

THERAPEUTICS

Drug Dosage for Children, Calculation of.—W. J. Dilling.
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Morphin, Negative Experimental Research on Transmission of, to Fetus and Suckling.—
Ztschr. f. Kinderh., Oct. 5, 1912.

Vaccine Therapy of Multiple Staphylococcus Abscesses in Infants. (Immunotherapie der multiplen Staphylokokkenhautabszesse der Säuglinge.)—P. v. Szily.
Wien. klin. Wchnschr., Oct. 31, 1912.

SURGERY AND ORTHOPEDICS

Femur, Fractures of Neck of, in Children and Youths.—G. Worms and A. Hamant.
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Femur, Suture of Traumatic Separation of Lower Epiphysis of the.—E. Desmarest.
Rev. de chir., October, 1912.

Harelip, Median.—J. Ransohoff.
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Humerus, Fractures of Lower End of the, in Children.—A. Trèves.
Arch. de méd. d. Enf., October, 1912.

Infantile Paralysis, Orthopedic Treatment of.—W. C. Campbell.
South. Med. Jour., November, 1912.

Orthopedic-Surgical Treatment of Poliomyelitic Paralysis in Children.—S. Peltesohn.
Deutsch. med. Wchnschr., Oct. 24, 1912.

Surgery of Children and Adults, Some Differences in.—E. W. Hedges.
Jour. Med. Soc. New Jersey, November, 1912.

Talipes Equino-Varus of Infants at Birth, Use of Adhesive Plaster in Cure of.—A. R. Allen.
Am. Jour. Obst., October, 1912.

MISCELLANEOUS

Anesthetics, Administration of, to Children.—G. E. Tuers.
Jour. Med. Soc. New Jersey, November, 1912.

Calcium, Influence of, on Cartilage *in vitro*. (Einfluss des Calciums auf die Knorpelquellung.)—H. Wolff.
Ztschr. f. Kinderh., Sept. 10, 1912.

Child Life, Responsibilities of Profession in Conservation of.—J. W. Amesse.
Texas State Jour. Med., October, 1912.

Criminals, Youthful, Psychology of. (Jugendlicher Verhafteter.)—K. Rupprecht.
München. med. Wchnschr., Oct. 8, 1912.

Infant Mortality, Importance of Hospitals for Infants and Their Part in Prevention of.—L. E. Holt.
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Infantile Summer Mortality in Austria. (Die gleichmässige Verteilung der Sommersterblichkeit der Säuglinge auf Stadt und Land in Oesterreich.)—L. Moll and E. Mayerhofer.
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Parenthood, Better, Education for.—T. D. Wood.
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Temperature in Child's Rectum, Technic for Taking.—P. Tachau.
München. med. Wchnschr., September, 1912.

INDEX TO VOLUME IV

Abt, I. A.: History of classification of gastro-intestinal diseases in ancient and modern times 65
Ager, L. C.: Paroxysmal hemoglobinuria 311
Albuminuria, orthostatic, summary of recent literature on 246
Amaurotic family idiocy, studies in metabolism of 234
Anderson, J. F., and J. Goldberger: Recent advances in our knowledge of measles 20
Anemia in children, treatment of, hypodermic use of hematinics, with report of cases 160
Appendicitis in childhood 97

Bass, M. H.: Summary of recent literature on orthostatic albuminuria 246
Benedict, F. G. and F. B. Talbot: Some fundamental principles in studying infant metabolism 129
Blackfan, K. D.: Apparatus for collecting infants' blood for Wassermann reaction 33
Blood-cultures during life in infants and young children, with description of new technic 197
Blood-pressures of children and young adults in various stages of tuberculosis, effects of cold air on 307
Blood-pressure readings, standardization of, by means of automatic device for reading systolic and diastolic pressures in children 46
Bookman, S., H. Heiman and B. B. Crohn: Studies in metabolism of amaurotic family idiocy 234
Bovaird, David, Jr.: On the mode of infection in epidemic cerebrospinal meningitis 317
Brady, J. M.: Use of polycarbohydrates in diet of young infant 89
Brain: Unusual lesion of the right crus in infant of four months 43
Bronchial glands, enlarged, diagnosis of 333
Burnett, H. W., and F. J. Farnell: Brain: unusual lesion of right crus in infant of four months 43
Burns, tetanus as a complication of 35

Cowie, D. M.: Graphic chart method of studying and teaching the principles of infant feeding 360
Crohn, B. B., H. Heiman and S. Bookman: Studies in metabolism of amaurotic family idiocy 234

Denny, O. T., B. S. Veeder and R. Kilduffe: Studies in bacteriology of acute intestinal diseases of infancy 75
Diarrhea, summer—heat—humidity 148

Eczema, infantile, and indigestion. Preliminary clinical study with illustrative cases 219

Farnell, F. J., and H. W. Burnett: Brain: unusual lesion of right crus in infant of four months 43
Feeding, high protein, influence of on intestinal flora, general metabolism and body temperature 265
Feeding, infant, and disorders of the digestive system: résumé of literature of past six months 104
Feeding, infant, principles of, chart method of studying and teaching 360
Feeding, long interval, of premature infants 391

Fowler, R. S.: Appendicitis in childhood 97
Freeman, R. G.; Serum treatment of pneumonia 383

Gastro-intestinal diseases, history of classification of, in ancient and modern times 65
Goldberger, Joseph, and J. F. Anderson: Recent advances in our knowledge of measles 20

Heiman, H., S. Bookman and B. B. Crohn: Studies in metabolism of amaurotic family idiocy 234
Helminthiasis in children 378
Hematinics, hypodermic use of, in treatment of anemia in children, with report of cases 160
Hemoglobinuria, paroxysmal 311
Hess, A. F.: Pancreatic ferments in infants 205
Holt, L. E., and P. A. Levene: Influence of high protein feeding on general metabolism, on intestinal flora and on body temperature of infants 265
Hoobler, B. R.: Effects of cold air on blood-pressures of children and young adults in various stages of tuberculosis 307
Hoobler, B. R.: Standardization of blood-pressure readings by means of automatic device for reading systolic and diastolic pressures in children 46

Inclusion bodies, leukocytic, with special reference to scarlet fever 1
Index of current pediatric literature 57, 121, 189, 258, 418
Intestinal diseases, acute, of infancy, studies in bacteriology of 75
Intestinal flora, influence of general metabolism and body temperature of infants, high protein feeding on 265

Jesionek, A.: Wassermann-Neisser-Bruck reaction 180

Kilduffe, R., B. S. Veeder and O. T. Denny: Studies in bacteriology of acute intestinal diseases of infancy 75
Knox, J. H. M. Jr., and T. P. Sprunt: Congenital obstruction of posterior urethra: report of case in boy aged 5 years 137
Kolmer, John A.: Leukocytic inclusion bodies with special reference to scarlet fever 1

Levene, P. A., and L. E. Holt: Influence of high protein feeding on general metabolism, on intestinal flora and on body temperature of infants 265
Litzenberg, J. C.: Long interval feeding of premature infants 391
Lowenburg, H.: Hypodermic use of hematinics in treatment of anemia in children, with report of cases 160

Measles, recent advances in our knowledge of 20
Meningitis, epidemic cerebrospinal, on the mode of infection in 317
Metabolism, general, influence of high protein feeding on intestinal flora and on body temperature of infants 265
Metabolism, infant, some fundamental principles in studying 129
Metabolism, studies in, of amaurotic family idiocy 234
Milk, certified, in infant feeding 256
Morgan, Edward, and M. Wollstein: Blood-cultures during life in infants and young children, with description of new technic 197
Morse, J. L.: Intestinal toxemia in the new-born 229
Murphy, W. W.: Helminthiasis in children 378

Newberger, Charles: Tetanus as a complication of burns 35
New-born, intestinal toxemia in 229

Ostheimer, M.: Infant feeding and disorders of digestive system: résumé of literature of past six months 104
Ott, Lambert: Clinical significance of abnormal respiration and deglutition click of fremitus: the pneumonic-respiration-pause cycle 7

Pancreatic ferments in infants 205
Pediatric literature, current, index of 57, 121, 189, 258, 418
Pediatrics, Progress in 57, 104, 180, 246, 323, 410
Pellagra in children. Preliminary report 172
Pirquet, v., cutaneous tuberculin test of, diagnostic value of 27
Pneumonia, serum treatment of 383
Polycarbohydrates, use of, in diet of young infant 89
Pottenger, F. M.: Relationship between infection in child and clinical tuberculosis in adult 13

Respiration, abnormal, and deglutition click fremitus, clinical significance of: the pneumonic-respiration-pause cycle 7
Respiratory system 410
Royster, L. T.: Summer diarrhea—heat—humidity 148
Ruhräh, John: Brief report of epidemic of sore throat with involvement of cervical lymph-nodes 301

Scarlet fever, leukocytic inclusion bodies with special reference to 1
Snyder, J. R.: Pellagra in children. Preliminary report 172
Sprunt, T. P., and J. H. M. Knox, Jr.: Congenital obstruction of posterior urethra: report of case of boy aged 5 years 137
Stoll, H. F.: Diagnosis of enlarged bronchial glands 333

Talbot, F. B.: Tuberculosis of mesenteric glands in infants and young children. Its effect on absorption 49
Talbot, F. B., and F. G. Benedict: Some fundamental principles in studying infant metabolism 129
Talbot, F. B., and H. P. Towle: Infantile eczema and indigestion. Preliminary clinical study with illustrative cases 219
Tetanus as a complication of burns 35
Throat, sore, with involvement of cervical lymph-nodes, brief report of epidemic of 301
Towle, H. P., and F. B. Talbot: Infantile eczema and indigestion. Preliminary clinical study with illustrative cases 219
Toxemia, intestinal, in the new-born 229
Tuberculin, cutaneous, test of v. Pirquet, diagnostic value of 27
Tuberculosis, clinical, in adult, relationship between infection in child and .. 13
Tuberculosis, effects of cold air on blood-pressures of children and young adults in various stages of 307
Tuberculosis of mesenteric glands in infants and young children. Its effect on absorption 49

Urethra, posterior, congenital obstruction of: report of case in boy aged 5 years 137

Veeder, B. S.: Respiratory system 410
Veeder, B. S., R. Kilduffe and O. T. Denny: Studies in bacteriology of acute intestinal diseases of infancy 75

Wachenheim, F. L.: Diagnostic value of cutaneous tuberculin test of v. Pirquet 27
Wassermann-Neisser-Bruck reaction 180
Wassermann reaction, apparatus for collecting infants' blood for 33
Wollstein, Martha, and E. Morgan: Blood-cultures during life in infants and young children, with description of new technic 197

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CONTENTS OF VOLUME IV

JULY, 1912 NUMBER 1

PAGE

LEUKOCYTIC "INCLUSION BODIES" WITH SPECIAL REFERENCE TO SCARLET FEVER. JOHN A. KOLMER, M.D., PHILADELPHIA 1

THE CLINICAL SIGNIFICANCE OF ABNORMAL RESPIRATION AND DEGLUTITION CLICK OR FREMITUS: THE PNEUMONIC-RESPIRATION-PAUSE CYCLE. LAMBERT OTT, M.D., PHILADELPHIA 7

THE RELATIONSHIP BETWEEN THE INFECTION IN THE CHILD AND CLINICAL TUBERCULOSIS IN THE ADULT. FRANCIS MARION POTTENGER, A.M., M.D., LL.D., MONROVIA, CAL. 13

RECENT ADVANCES IN OUR KNOWLEDGE OF MEASLES. JOHN F. ANDERSON AND JOSEPH GOLDBERGER, WASHINGTON, D.C. 20

THE DIAGNOSTIC VALUE OF THE CUTANEOUS TUBERCULIN TEST OF v. PIRQUET. E. L. WACHENHEIM, M.D., NEW YORK 27

APPARATUS FOR COLLECTING INFANTS' BLOOD FOR THE WASSERMANN REACTION. KENNETH D. BLACKFAN, M.D., ST. LOUIS 33

TETANUS AS A COMPLICATION OF BURNS. CHARLES NEWBERGER, B.S., M.D., CHICAGO 35

AN UNUSUAL LESION OF THE RIGHT CRUS IN AN INFANT OF FOUR MONTHS. FREDERIC J. FARNELL, M.D., AND HENRY W. BURNETT, M.D., PROVIDENCE 43

STANDARDIZATION OF BLOOD PRESSURE READINGS BY MEANS OF AN AUTOMATIC DEVICE FOR READING SYSTOLIC AND DIASTOLIC PRESSURES IN CHILDREN. B. RAYMOND HOOBLER, M.D., NEW YORK 46

TUBERCULOSIS OF THE MESENTERIC GLANDS IN INFANTS AND YOUNG CHILDREN. ITS EFFECT ON ABSORPTION. FRITZ B. TALBOT, M.D., BOSTON 49

PROGRESS IN PEDIATRICS—INDEX OF CURRENT PEDIATRIC LITERATURE 57

AUGUST, 1912 NUMBER 2

PAGE

HISTORY OF THE CLASSIFICATION OF GASTRO-INTESTINAL DISEASES, IN ANCIENT AND MODERN TIMES. ISAAC A. ABT, M.D., CHICAGO 65

STUDIES IN THE BACTERIOLOGY OF THE ACUTE INTESTINAL DISEASES OF INFANCY. BORDEN S. VEEDER, M.D., ST. LOUIS, AND ROBERT KILDUFFE AND O. T. DENNY, PHILADELPHIA 75

USE OF POLYCARBOHYDRATES IN THE DIET OF THE YOUNG INFANT. JULES M. BRADY, B.S., M.D., ST. LOUIS 89

APPENDICITIS IN CHILDHOOD. RUSSELL S. FOWLER, M.D., BROOKLYN, N. Y. 97

PROGRESS IN PEDIATRICS:

Abstract: Infant Feeding and Disorders of the Digestive System. Résumé of the Literature of the Past Six Months. Maurice Ostheimer, M.D., Philadelphia 104

INDEX OF CURRENT PEDIATRIC LITERATURE 121

SEPTEMBER, 1912 NUMBER 3

PAGE

SOME FUNDAMENTAL PRINCIPLES IN STUDYING INFANT METABOLISM. FRANCIS G. BENEDICT, PH.D., AND FRITZ B. TALBOT, M.D., BOSTON 129

CONGENITAL OBSTRUCTION OF THE POSTERIOR URETHRA: REPORT OF A CASE IN A BOY AGED FIVE YEARS. J. H. MASON KNOX, JR., M.D., AND T. P. SPRUNT, M.D., BALTIMORE 137

SUMMER DIARRHŒA — HEAT — HUMIDITY. LAWRENCE T. ROYSTER, M.D., NORFOLK 148

THE HYPODERMIC USE OF HEMATINICS IN THE TREATMENT OF ANEMIA IN CHILDREN, WITH REPORT OF CASES. H. LOWENBURG, A.M., M.D., PHILADELPHIA 160

PELLAGRA IN CHILDREN. A PRELIMINARY REPORT. J. ROSS SNYDER, M.D., BIRMINGHAM, ALA. 172

PROGRESS IN PEDIATRICS: THE WASSERMANN-NEISSER-BRUCK REACTION. PROF. DR. A. JESIONEK, GIESSEN. ABSTRACTED BY HARVEY PARKER TOWLE, M.D., BOSTON 180

INDEX OF CURRENT PEDIATRIC LITERATURE 189

CONTENTS OF VOLUME IV

OCTOBER, 1912. NUMBER 4

PAGE

Blood-Cultures During Life in Infants and Young Children, with Description of a New Technic. Martha Wollstein, M.D., and Edward Morgan, M.D., New York 197

The Pancreatic Ferments in Infants. Alfred F. Hess, M.D., New York ... 205

Infantile Eczema and Indigestion. Preliminary Clinical Study with Illustrative Cases. Harvey P. Towle, M.D., and Fritz B. Talbot, M.D., Boston 219

Intestinal Toxemia in the New-Born. John Lovett Morse, A.M., M.D., Boston 220

Studies in Metabolism of Amaurotic Family Idiocy. Henry Heiman, M.D., Samuel Bookman, Ph.D., and Burrill B. Crohn, M.D., New York 234

Progress in Pediatrics: A Summary of the Recent Literature on Orthostatic Albuminuria. Murray H. Bass, M.D., New York 246

Certified Milk in Infant Feeding 256

Index of Current Pediatric Literature 258

NOVEMBER, 1912. NUMBER 5

PAGE

The Influence of High Protein Feeding on the General Metabolism, on the Intestinal Flora and on the Body Temperature of Infants. L. Emmett Holt, M.D., and P. A. Levene, M.D., New York 265

A Brief Report of an Epidemic of Sore Throat with Involvement of the Cervical Lymph-Nodes. John Ruhrah, M.D., Baltimore 301

Effects of Cold Air on Blood-Pressures of Children and Young Adults in Various Stages of Tuberculosis. B. Raymond Hoobler, A.M., M.D., New York 307

Paroxysmal Hemoglobinuria. Louis C. Agee, M.D., Brooklyn 311

On the Mode of Infection in Epidemic Cerebrospinal Meningitis. David Bovaird, Jr., M.D., New York 317

Index of Current Pediatric Literature 323

DECEMBER, 1912. NUMBER 6

PAGE

Diagnosis of Enlarged Bronchial Glands. Henry Farnum Stoll, M.D., Hartford, Conn. 333

A Graphic Chart Method of Studying and Teaching the Principles of Infant Feeding. David M. Cowie, M.D., Ann Arbor, Mich. 360

Helminthiasis in Children. W. W. Murphy, M.D., Chicago 378

Serum Treatment of Pneumonia. Rowland Godfrey Freeman, M.D., New York 383

Long Interval Feeding of Premature Infants. J. C. Litzenberg, M.D., Minneapolis 391

Progress in Pediatrics: Respiratory System. Borden S. Veeder, M.D., St. Louis 410

Index of Current Pediatric Literature 418

CONTENTS

	PAGE
Diagnosis of Enlarged Bronchial Glands. Henry Farnum Stoll, M.D., Hartford, Conn.	333
A Graphic Chart Method of Studying and Teaching the Principles of Infant Feeding. David M. Cowie, M.D., Ann Arbor, Mich.	360
Helminthiasis in Children. W. W. Murphy, M.D., Chicago.	378
Serum Treatment of Pneumonia. Rowland Godfrey Freeman, M.D., New York	383
Long Interval Feeding of Premature Infants. J. C. Litzenberg, M.D., Minneapolis	391
Progress in Pediatrics: Respiratory System. Borden S. Veeder, M.D., St. Louis	410
Index of Current Pediatric Literature	418

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